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BABESIASIS (PIROPLASMOSIS), NUTTALLIASIS, AND ANAPLASMOSIS.

(128) CARPANO (M.). **Kultur der Pferdepiroplasmen und Betrachtung über die Natur der Anaplasmen.** [The Cultivation of the Piroplasms of the Horse and Views regarding the Nature of Anaplasms.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 42-53. With 1 plate.

The following is the method employed for the cultivation of both *Nuttallia equi* and *Piroplasma caballi*.

Tubes are prepared containing 1 cc. of distilled water in which sodium chloride and sodium citrate have been dissolved, each in the proportion of 7 per cent. To these are added 9 cc. of fresh defibrinated blood containing the parasites. The tubes are incubated at 25° C.

The author has not been able to get undoubted multiplication of the parasite in the case of *Babesia caballi*. After 48 hours incubation numbers of the pear-shaped parasites are extracellular. Certain changes are to be observed in their chromatin. In some of the parasites the chromatin forms a small round compact mass, while in others it has a loose texture.

By the fifth to the eighth day regular and irregular star-shaped parasites may be seen. The rays of the stars are formed either of cytoplasm alone or partly of chromatin. At the same time there make their appearance large rounded elements, which are composed for the most part of faintly-stained cytoplasm. From the 10th to 15th day large irregular parasites possessing two pieces of chromatin can be found. One of the chromatin masses is large and usually round, the other is small and frequently thread-like.

Subsequently no further development takes place and after a variable length of time the parasites degenerate, the medium at the same time becoming completely haemolysed.

The author considers that these forms must represent sexual forms.

In cultures *Nuttallia equi* does not retain its vitality so long as *B. caballi*, but certain morphological changes and definite multiplication can be observed.

During the first 48 hours the large and medium-sized parasites which are present in the circulating blood almost entirely disappear, and cross-forms are very seldom seen. The bulk of the parasites

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are small and are composed for the most part of chromatin, and indeed some appear to be composed of chromatin entirely.

The process of multiplication is one of direct division in which the chromatin first divides and subsequently the cytoplasm. Corpuscles containing 1, 2, 3, or 4 parasites may be seen. In the latter case they are very small and their arrangement recalls the classical cross-forms. Free forms containing one or two chromatin masses are not infrequently found.

By the 3rd or 4th day the parasites appear to have become even smaller, and shew a tendency to arrange themselves at the periphery of the red corpuscles.

About the 6th to 8th day very small rings and bacillary forms are to be found, and about the same time forms occur possessing the morphological features of anaplasms, but in some of these a rim of cytoplasm can be detected. Parasites which have undergone division either escape from the red cells or are set free from them by their disruption, and would appear from stained preparations to enter fresh ones.

Free forms of the parasite are motile.

By the 20th to 30th day practically all the parasites present the morphological characters of anaplasms, and by this time haemolysis is almost complete.

The author had only one doubtful success in his attempts to transfer the cultures to fresh tubes.

The author has found the anaplasm-like parasites in horses suffering from and recovering from nuttalliasis, and he has also seen cases in which only the anaplasm forms were to be found.

In the portion of the paper dealing with the nature of anaplasms the author summarises at some length the views expressed by various authors, and concludes that anaplasms cannot be considered as absolutely unconnected with the life-cycles of piroplasms.

(129) Carpano (M.). **Piroplasmosis equina.**—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 13-40. With 3 plates and 6 text-curves.

In this paper the author describes in some detail his observations regarding the occurrence of two types of parasite in equine piroplasmosis in Italy. His description of the morphology of the organisms and their methods of multiplication closely agrees with that given by Nuttall and Strickland in 1912.

The author believes that *R. bursa* and *B. annulatus* are the transmitting ticks under natural circumstances, but has apparently been unable to furnish experimental evidence of this.

The clinical, pathological, and epizootiological characters of the two conditions are dealt with at some length.

The author's conclusions are as follows :

1. Equine piroplasmosis may be caused by two distinct parasites, one of which is of comparatively small size. This parasite is characterised by a special method of multiplication which results in the formation of four parasites arranged in the form of a cross. The name *Nuttallia equi* has been given to this parasite. The other parasite is of larger size, and occurs in the form of twin pear-shaped bodies. This parasite multiplies

in the circulating blood by a process of true budding. This organism is known as *Babesia caballi.*

2. The two parasites have a wide distribution, especially in the Old World. *Nuttallia* appears to have a wider distribution than *Babesia caballi.*

Both forms occur in Italy, and, of the two, *Nuttallia* has a wider distribution. Only *Babesia caballi* has been observed up to the present in Eritrea.

3. In Italy a large proportion of the native horses possess a certain degree of immunity, which appears to be partly natural and partly acquired. Imported horses are very susceptible.

4. There are no very marked distinguishing features between the clinical and pathological features presented by the diseases caused by the two types of parasite. There are certain characters of an epizootiological nature which are special to the two diseases.

5. Under natural conditions the diseases are transmitted by *Rhipicephalus bursa* and *Boophilus annulatus*, the latter being responsible for the transmission of *Babesia caballi.*

The diseases are transmissible by blood inoculation, and in cases where failure results this is due to immunity of the animals used.

6. When an animal has recovered from one of the forms of the disease it remains immune to it for a variable length of time. Owing to this fact it has been possible to separate the two types of parasite. An animal that is immune to *Nuttallia equi* can be infected with *Babesia caballi* and vice versa.

(130) Schellhase (W.). **Ein Beitrag zur Kenntnis der Piroplasmosis der Schafe und Esel. Therapeutische Versuche mit Trypanblau. Ueber die Anaplasmosis der Esel.** [Piroplasmosis of the Sheep and Donkey. Therapeutic Experiments with Trypanblue. Anaplasmosis of the Donkey.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1914. Feb. Vol. 15. No. 1. pp. 93-97.

The experiments recorded in this paper were carried out with the object of investigating the course of the disease in cases of acute piroplasmosis, the susceptibility of the goat to the piroplasm of the sheep, and the effect produced by trypanblue, if any, upon the course of the disease in the acute stages.

Two young and clinically healthy goats and sheep were inoculated subcutaneously with 20 cc. of defibrinated blood from a sheep infected with piroplasmosis. Parasites were comparatively numerous in the blood.

A few anaplasms were found in the blood of one of the goats before inoculation but no piroplasms. The details of the experiments are a little difficult to follow as the results of daily examinations of the blood are not given.

Apparently anaplasms were first observed in the blood of goat 1 on the 8th day, and piroplasms three days later.

The blood of goat 2 which contained anaplasms at the time of inoculation, was found to be negative on the following day and on the 6th day after inoculation. On the 9th day anaplasms again appeared, to disappear the following day.

Sheep 1 had piroplasms in its blood on the 1st, 9th, 10th and 14th days after inoculation.

Sheep 2. Piroplasms were found on the 8th day and again on the 14th day.

The temperatures of the animals ranged from 38·5° to 41·3° C.

The author concludes from these experiments that piroplasms and anaplasms may be present in the blood of clinically healthy sheep, and suggests the probability that the majority of sheep and goats contract piroplasmosis and anaplasmosis during early life, and either recover or die. It is due to this fact that the experiments had doubtful results.

Piroplasmosis of the donkey.—Up to the present occasional cases only of piroplasmosis of the donkey have been discovered in German East Africa. The author has recently encountered two actual outbreaks of the disease. In one instance 4 out of 11 animals were found to be affected, and in another 10 out of 14. About 25 out of 75 donkeys died during the rains (principally foals) and five mares aborted. In the donkey the disease generally takes a chronic course. The piroplasms are rather longer than *Piroplasma mutans*, and the chromatin is relatively large in amount; "ring," "note," "pear-shaped," and "match-like forms" occur. Parasites are generally scanty in the blood.

Effects of trypanblue.—Five emaciated donkeys were given 40 to 100 cc. of 2 per cent. trypanblue intravenously, but no curative effects were produced.

Anaplasmosis of the donkey.—In the blood of two of the animals treated with trypanblue bodies resembling anaplasms were found, in addition to the piroplasms. On a number of occasions the appearance presented by the bodies suggested multiplication.

TRYPANOSOMIASIS.

(131) Leese (A. S.). **Preliminary Report on Military Camels in Jubaland.**—Manuscript Report forwarded from the Colonial Office on April 23rd, 1914.

The author was detailed to proceed to Kismayu, Gobwen, and Serenli, to investigate the causes of mortality and unthriftiness in camels.

At Gobwen, where the author spent six days, there were 30 riding-camels of the Camel Corps, and of these at least 30 per cent. were affected with trypanosomiasis, clinically indistinguishable from surra. Advice was given regarding the suitability of certain grazing grounds and the diet of the animals. At Serenli, where there were 80 camels, only 10 were found to be affected with trypanosomiasis. Owing to continual movement it was impossible to trace the source of infection, but three of the infected animals were remounts only just arrived from Gobwen.

The principal causes of the mortality, amounting to 35 per cent. per annum, were the unfavourable conditions to which the animals were subjected on arrival in Jubaland, resulting in loss of condition, exhaustion, and death due to pneumonia, lung-abscess, and enteritis.

The unfavourable conditions were:

1. Putting animals to hard work when not in fit condition.
2. Working immature animals.
3. Particularly active patrol work, rendering it impossible to study the needs of the camels in so full a manner as under ordinary conditions.

4. Apathy on the part of the men regarding their animals.
5. Working camels hard through the hot season.
6. The feeding on an insufficient quantity of uncrushed grain, badly infested with weevils.
7. Absence of veterinary advice and suitable food for sick animals.
8. The frequency of sore backs.

Most of the animals were in very poor condition and there were many cases of necrosis of the skin, a disease termed "Gub" (or in India "Joolak"). In most cases the poor condition was not due to disease.

The cases of trypanosomiasis were isolated; one which had also a lung abscess was destroyed. Nine of the animals were rested for four months and then used for safari. Eleven of the total number of animals were 5½ years old or under, and these were kept from hard work until the second pair of permanent incisors were cut (rising 6 years old).

Fly surveys were made from Selagli to Lalashid and Gaba-hari (the northernmost outposts), over routes most frequently used, and warnings against certain camps and grazing grounds given.

Recommendations regarding the management of riding-camels.—

Arab camels require about 5 months to become acclimatised, and should be bought at about 5 years old, so that they may become acclimatised to the country and feeding in the East African Protectorate and be ready for work at rising 6 years old.

The corn ration should be 8 pounds when the animals are at work or grazing between safaris. Millet and grain are the best, particularly the former, as it can be obtained locally. If sim-sim cake, cottonseed, or maize are used, these should not form more than ⅜ of the ration. All grain should be crushed. If given uncrushed, millet and grain should be first soaked. In the absence of salt-bush, ¾ ounce of crushed rock-salt should be given when nôt on safari. The salt should be given every third or fourth day (i.e. 2¼ to 3 ounces), on watering day, first thing in the morning.

No marching should be done between 10.30 and 3 o'clock in the cool season, and these hours should be earlier and later respectively in the hot season. The average daily distance for fit riding-camels on safari is about 20 miles. A good rest should be given before the next safari.

Camels should be trained to go for four days without water in the dry season.

Saddles should be so constructed as to prevent pressure on the spine. This pressure is the most frequent cause of sore backs. Among 200 transport camels at Serenli 64 cases of trypanosomiasis had been discovered up to date, and this is the principal cause of death. Grain is not necessary for transport camels if they are properly cared for and are not unduly pushed. The distance covered daily on safari should not exceed 15 miles, and a rest should be given before the next safari is undertaken. The marches should be averaged, provided water supplies permit.

For working Somali camels not getting grain, watering in the dry season should be every three days.

Well-grown camels can carry 300 pounds if well cared for and under proper conditions on safari.

Marching by rivers should be avoided whenever possible, especially during rains and for four or five weeks after. When it is necessary, the less valuable camels should be used, and marching should be carried out at night, the animals grazing in the desert.

It is probably only below Selagli that travelling by river route is dangerous at all times.

A report on trypanosomiasis, the distribution of biting flies, and on other infective diseases and preventive measures will follow later.

(132) Yakimoff (W. L.) & Schokhor (N. I.). **Recherches sur les Maladies tropicales Humaines et Animales au Turkestan. (3) Les Trypanosomiases des Chameaux et des Anes au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (3) The Trypanosomiases of the Camel and the Ass in Turkestan.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 187-188.

The authors have examined 476 camels, and have found 22 infected, but they state that this figure is probably too low, as camels may be infected without the parasite being discoverable in the peripheral blood.

The parasite was in all cases transmissible to guinea-pigs, and is said to be of the surra-nagana type. The possibility is suggested that it is in reality the trypanosome of Indian surra. They have never observed trypanosomes in the peripheral blood of mules and donkeys in Turkestan, but they state that at Bukhara they took from 1 to 3 drops of blood from 216 donkeys, diluted it with physiological serum and inoculated a guinea-pig subcutaneously. The animal became infected, the trypanosome being of the same type as that found in the camels.

(133) Laveran (A.). **L'Agent du Debab d'Algérie est le *Trypanosoma soudanense* (Laveran).** [The Causal Agent of Debab is *Trypanosoma soudanense.*]—*Compt. Rend. Acad. Sci.* 1914. Jan. 12. Vol. 158. p. 93.

The author has carried out a fresh series of experiments shewing that Debab is caused by *T. soudanense*, a trypanosome originally obtained from the Upper Niger.

Cross immunity experiments have been carried out. The strains used were the original *soudanense* strain sent to France in 1906 by Cazalbou and since kept running in guinea-pigs, and the debab virus obtained from a dromedary from the Touggourt-Biskra district.

The animals employed were: A goat having a high degree of immunity to *T. soudanense*, a control goat, and a goat immune to surra, which according to certain observers is allied to debab.

The experiments had the following results:—

The goat possessing immunity for *T. soudanense* resisted infection with the trypanosome that is responsible for debab, while the control goat and that immune to surra became infected. In a previous publication the author shewed that cattle immune to debab resisted infection with *T. soudanense*, and in the present note evidence is furnished that a goat immune to *T. soudanense* resists infection with

debab. The demonstration of the identity of the viruses is therefore complete.

The strain of *T. soudanense* in the possession of the author is slightly more active than the Algerian strain of the debab virus, and this explains why some animals immune to the latter became infected by the former.

In order to avoid this source of error in carrying out cross immunity experiments for the identification of two viruses, the immunity towards each must be tested by the other.

(134) Blacklock (B.) & Yorke (W.). **The Probable Identity of *Trypanosoma congolense* (Broden) and *T. nanum* (Laveran.)**—*Ann. Trop. Med. & Parasit.* 1913. Dec. 30. Vol. 7. No. 4. pp. 603-607.

In a previous paper (see this *Bulletin* Vol. 1, p. 76) a description was given of two parasites found in the blood of a horse imported from the Gambia. These parasites were separated accidentally. One was certainly *T. vivax*, but regarding the identity of the other there was some doubt.

The authors succeeded in infecting small animals with this trypanosome and finally decided that it was *T. dimorphon* (*T. congolense*). They have been able to maintain this parasite in rats. The subinoculations made from the time of isolation up to the 57th generation are shewn in a table, and from this the following information may be gathered.

1. Most of the early inoculations failed, while subsequently they were invariably successful.

2. The course of the disease in the earlier generations was chronic, and in the later ones acute. The average length of life of the rats from the 5th generation (when the strain was firmly established in the rat) to the 14th, was 88·6 days, but the average duration of life of the rats in the 42nd to 51st generations was only 8·6 days.

This appears to the authors to have some significance in connection with the nomenclature of the parasite. *T. congolense* and *T. nanum* are morphologically identical. They are spread by the same species of fly, and flies are infected in the same manner by each parasite. Had only a small number of experimental animals been available, as is usually the case in the tropics, the trypanosome would probably have been identified as *T. nanum*. Weissenborn described a short aflagellar trypanosome of equines in Togoland in 1911 and stated that it was of inconstant virulence.

The Sleeping Sickness Commission of the Royal Society state that *T. pecorum* loses its pathogenicity for other animals by passage through goats, thus giving rise to the erroneous idea that a separate species, *T. nanum*, exists.

The Belgian Sleeping Sickness Commission have found that aflagellar trypanosomes occurring in dogs are not always pathogenic for the rat and guinea-pig.

The authors can therefore find no evidence warranting a distinction being made between the morphologically identical parasites *T. congolense* and *T. nanum*, on the grounds of pathogenicity.

(135) TRAUTMANN (R.). **Inoculation Positive de *Trypanosoma cazalboui* á un *Cercopithecus patas*.** [Successful Inoculation of a *Cercopithecus patas* with *Trypanosoma cazalboui*.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 118-121.

With the exception of a few cases of transient infection in rats and guinea-pigs, *T. cazalboui* is as a rule transmissible to ruminants and equidae only. A *Cercopithecus patas* was inoculated subcutaneously with 5 cc. of blood containing large numbers of trypanosomes from a calf which was on the point of death.

On the third day there was distinct autoagglutination of the red corpuscles. Trypanosomes appeared in the blood in very small numbers on the 6th day. On the 9th day, when no trypanosomes could be found in the blood, a sheep, a native dog, a young guinea-pig, a cynocephalus monkey, two grey rats, and a rabbit were inoculated from it. Trypanosomes were not seen again until the 11th day. On this day the monkey died.

At the post-mortem, all the glands, the liver, spleen, and kidneys were found to be enlarged.

The blood shewed a few degenerating trypanosomes, but none were found in one of the mesenteric glands.

The dog, guinea-pig, cynocephalus monkey, and rabbit failed to become infected. The rats never shewed trypanosomes in their blood, but they died on the 12th and 18th days. The sheep became infected and trypanosomes were found on the 8th day. Two patas, a rabbit, and a guinea-pig inoculated from the sheep failed to become infected, but a kid died on the 20th day. The trypanosome was identified by MESNIL.

(136) DELANOË (P.). **Des Variations du Pouvoir Infectieux et de la Virulence du *Trypanosoma dimorphon*, à partir d'Infections Naturelles présentées par les Boeufs et les Moutons. Note préliminaire.** [Variations in the Pathogenicity and Virulence of *T. dimorphon* derived from Natural Cases in the Ox and Sheep.] —*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 58-63.

During a period of rather less than 6 months the author has examined some 3000 cattle and sheep for trypanosomiasis. The examinations were made in the course of the inspection of animals passing down from Upper Senegal and the Niger to the coast. For the detection of trypanosomes a single examination of moist blood was made, the animals which were declared free from infection upon the result of this examination being allowed to proceed. The only trypanosomes encountered were *T. cazalboui*, *T. dimorphon*, and *T. pecaudi*. The latter was found in a few instances only.

A series of 7 sets of experiments were carried out with *T. dimorphon*. In five instances the trypanosome (derived from 3 oxen and 2 sheep) was not inoculable directly to either the rat or the guinea-pig. In one case the trypanosome was transmitted directly to the rat, but not to the guinea-pig, and in the remaining case it was inoculable to both the rat and the guinea-pig.

Details are given of the experiments, and from these it appears that rats and guinea-pigs may possess complete immunity against

T. dimorphon, repeated intraperitoneal inoculations with small quantities of virulent blood, and single intraperitoneal or intravenous inoculations with large quantities failing to break the immunity down.

In the instance in which the rat became infected while the guinea-pig proved refractory, the infection in the rat was a very slight one. Trypanosomes were found in its blood in very small numbers on the 21st and 81st days only.

The last series of experiments shewed that the trypanosome is capable of setting up a rapidly fatal infection in both the rat and the guinea-pig. In this instance two white rats and one out of the two guinea-pigs inoculated from the infected ox shewed a mixed infection of *T. dimorphon* and *T. pecaudi*, and died. A goat, whose blood had failed to cause any infection when inoculated into a rat, was inoculated from the ox, and contracted the dimorphon infection only. From this goat five field rats and two guinea-pigs were inoculated with fatal results.

The author does not think that there are any specific differences between the trypanosomes without free flagellum which are directly inoculable to rodents and those that are not. There is no essential morphological difference.

In a future paper the author proposes to shew that he has been able to inoculate rats with the virus against which rats possessed a complete immunity at the first inoculation.

The author believes that there are several strains of *T. dimorphon* which differ from each other only in the varying susceptibility possessed by animals towards them.

(137) Laveran (A.) & Marullaz (M.). **Essais d'Immunisation contre le Nagana Expérimental des Souris.** [Attempts to immunise Mice against Experimental Nagana.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 53-58.

The experiments of Rondoni and Goretti have been repeated using trypanosomes subjected to salvarsan in very dilute solutions as the immunising agent. The strain used was the "ferox" strain (Ehrlich).

In all, eight experiments were made, and six mice were used in each. The full details of four of the experiments are given and the remainder are summarised. The trypanosomes were obtained by centrifuging blood containing large numbers after the addition of citrated broth, and recentrifuging. The trypanosomes so obtained were mixed with the salvarsan solutions varying in strength from 1 in 1,000 to 1 in 40,000. These were left for half an hour at room temperature, centrifuged, washed with salt solution, and injected.

The results obtained differed in a marked degree from those of Rondoni and Goretti. Whereas the latter authors obtained an absolute immunity in 40 to 50 per cent. of animals, Laveran and Marullaz have not obtained a permanent immunity in any instance.

In 30 instances a more or less rapid infection followed the immunisation. Of 18 cases in which vaccination did not cause infection, 16 became infected when tested, and two which resisted a first infection became infected when a second dose of active virus was administered.

A slowing of the movements of the trypanosomes in the salvarsan solutions is not a sufficient guide as to the effects of the salvarsan. Dilutions of 1 in 10,000 to 1 in 5,000 simply increased the period of incubation, and dilutions of 1 in 1,000 and 1 in 2,000 yielded the same results as dead trypanosomes, i.e. failed to produce either infection or immunity.

(138) Johns (F. M.). *Trypanosoma americanum.—New Orleans Med. & Surg. Jl.* 1914. Jan. Vol. 66. No. 7. pp. 533-534.

While working upon the cultivation of *B. bigeminum* the author encountered a very large trypanosome in the blood of a calf, and subsequently found 43 adult animals and 2 yearlings to be infected, by direct examination.

It was found possible to cultivate the trypanosome by adding half the volume of 1 per cent. dextrose to defibrinated cow's blood and incubating at any temperature from 27° to 40° C. It was found that the addition of serum containing complement to the cultures after the first 24 hours destroyed them. The author concludes from this that if an insect transmitter feeds again before the trypanosomes contained in the infective feed reach the hind gut, the insect becomes non-infective.

(139) Delanoë (P.). **Le Fonctionnement du Service de Prophylaxie à Bouaké (Côte d'Ivoire) à l'Egard des Trypanosomiases Animales du 10 Juin au 31 Déc. 1913.** [The Working of the Prophylactic Measures against Animal Trypanosomiases at Bouaké (Ivory Coast) from 10th June to 31st December, 1913.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 152-160. With 1 map.

The new sanitary measures involve the systematic examination of the blood of animals passing through Bouaké. The rule adopted is, that only those animals in which trypanosomes cannot be found at a single examination are allowed to go to the coast. Affected animals are kept under observation at Bouaké, or if sufficiently fat are slaughtered.

Only three or four horses have been examined, the remaining animals being cattle and sheep coming for the most part from Upper Senegal and the Niger. Out of 4,086 animals (2,115 cattle, 1,971 sheep) only 214 came from the Ivory Coast. Bouaké is the centre of the cattle traffic, the herds from the Soudan being brought there by middlemen for transmission to the coast and other parts.

The animals are inspected before they are sold and are branded in a manner indicating whether they have passed the examination or not, so that the loss rests principally on those bringing the animals to Bouaké. Infected animals that are in sufficiently good condition to be slaughtered and consumed locally fetch considerably lower prices than those that are passed.

Animals may be rejected on account of emaciation alone, and to save time the blood of these is not subjected to examination.

Emaciated animals may have no trypanosomes in their blood and in

the blood of fat animals they may be numerous. This is explained by the fact that the number of trypanosomes present in the blood at different stages of infection varies. The meat from well-nourished infected animals does not differ in any way from that of healthy animals.

Twenty-one per cent. of the cattle were found to be infected, and 4·6 per cent. were condemned for emaciation.

Of the sheep 10·4 per cent. were condemned for trypanosomiasis and 0·8 per cent. for emaciation.

A table is given shewing the number of cattle and sheep examined each month during the period under review. The increase in the number of animals inspected during December as compared with the previous months indicates that the inspection has not hindered trade.

Of the three types of Soudan cattle (the Zebu or large humped animals, the small animals without humps, and the cattle with small humps), the first are most frequently found to be infected and they do not bear long journeys well.

The animals that are infected to the smallest extent, and are less frequently emaciated, are those from Lobi. The herds having the highest percentage of diseased and emaciated animals were those from Macina, where souma occurs in a very virulent form.

The only trypanosomes encountered were the *T. cazalboui*, *T. dimorphon* and the *T. pecaudi*, in order of their frequency.

The author states that confirmation can be furnished of the part played by Stomoxys in the transmission of souma. The inspection has been criticised as hindering trade, but the author states that apart from any consideration of prophylaxis the inspection has lead to an improvement in the quality of the animals.

(140) Mesnil (F.) & Blanchard (M.). **Sur l'Identification du Virus d'un Cas de Trypanosomiase Humaine contractée au Laboratoire.** [The Identification of the Virus in a Case of Human Trypanosomiasis contracted in the Laboratory.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 196-200.

The case referred to in this paper is that of Professor Lanfranchi of Parma.

It is said that only two strains of trypanosomes, namely, nagana and surra, had ever been kept at the University of Parma.

A strain of the trypanosome which was thought to be the cause of Lanfranchi's infection was obtained from Parma, and animals were inoculated from Lanfranchi himself.

A number of investigations were carried out with these trypanosomes and the sera from infected animals, and the general results indicated that the animal strain received from Parma and that isolated from Lanfranchi were quite distinct.

Cross immunity tests and the actions of protective sera indicated that the strain derived from Lanfranchi did not differ from *T. gambiense*, and that the animal strain derived from Parma was *T. evansi*.

The authors are not prepared to state definitely that the strain from the human source was actually *T. gambiense*.

(141) Roubaud (E.) & Lafont (A.). **Expériences de Transmission des Trypanosomes Humains d'Afrique par les Moustiques des Habitations** (*Stegomyia fasciata*). [Experiments regarding the Transmission of the Human Trypanosomes in Africa by Mosquitoes (*Stegomyia fasciata*).]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 49-52.

The authors have used *T. gambiense* and *T. rhodesiense*, and monkeys, guinea-pigs, and rats were employed. It was found that transmission occurred in those cases only in which the mosquitoes were immediately transferred to susceptible animals from infected animals which had numerous trypanosomes in their blood. The authors point out, however, that the experiments are not strictly comparable with infection of man because of the hair covering the animals' bodies, this rendering it difficult for the mosquitoes to bite. The experiments also shewed that the virus does not remain active in the mosquito for more than 24 hours.

(142) Prentice (G.). **Sleeping Sickness, Tsetse, and Big Game.**—*Brit. Med. Jl.* 1914. Feb. 7. pp. 293-294.

This paper contains a general summary of the author's experiences in connection with game and tsetse fly in Nyasaland and Rhodesia, where, save for three periods of furlough, he has worked since 1894.

He speaks with personal experience of large tracts of country where not a single fly was encountered years ago, and where now they abound. He attributes the spread of the fly to the increase in the number of game animals, and this in turn is attributed to the protective measures put into force by the Government. The lives of men and domesticated animals are being lost as a result of this spread of the fly.

The author advocates a general onslaught on wild animals as offering the best chance of eradicating trypanosomiases. He does not believe that the destruction of the game would lead to the fly attacking man and domesticated animals, and expresses the opinion that with the destruction of the game the fly would disappear.

(143) Weck. **Beobachtungen über Trypanosomen des Menschen und der Tiere am Rovuma-Flusse.** [Observations on the Trypanosomes of Man and Animals on the Rovuma River.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Feb. Vol. 18. No. 4. pp. 113-124.

The question of the identity of the trypanosomes occurring along the Rovuma is of practical importance on account of the fact that *Glossina palpalis* does not occur along the course of the Rovuma from Mitomoni to Sasawara, but only *G. morsitans*. Although the latter fly has a wide distribution in German East Africa it appears up to the present to have been a source of danger to domesticated and wild animals only, no case of trypanosomiasis having been observed in man.

The trypanosome found along the Rovuma is said to be morphologically and biologically distinct from *T. gambiense*, and, according to Taute, identical with *T. rhodesiense*.

The view expressed by Bruce that *T. rhodesiense* is identical with *T. brucei* is questioned, and it is said that while nagana is of common occurrence in wild and domesticated animals in the *Glossina morsitans*

district, cases of trypanosomiasis in man have not been observed. It should be noted that the diagnosis of nagana is based in the great majority of cases upon microscopic examination. The explanation of the absence of trypanosomiasis in man is possibly that *T. rhodesiense* requires certain climatical conditions, and, particularly, higher temperatures. There are however many areas in the colony with the same climatic and geographical condition where game is plentiful and *Glossina morsitans* occurs in large numbers, but in which trypanosomiasis has not been observed in man.

The possibility is not excluded that the trypanosome recognised as *T. brucei* in German East Africa is not the same as that occurring in Nyasaland and Rhodesia, and when diagnosis is based upon microscopic examination it is quite possible to confuse trypanosomes.

A number of species of wild and domestic animals have been found to be infected with trypanosomes by direct microscopic examination in the Mitomoni, Sasawara, and Lumesule Districts, and a number of positive experimental infections have been obtained.

Positive results were obtained in every case when monkeys were inoculated with blood containing the trypanosome occurring in man, no matter from what species of animal the infective material was obtained. In some cases an exaltation of virulence was observed when the trypanosome was carried on from one animal to another of the same species. Strains of trypanosomes which are not transmissible to the monkey are probably not identical with the human strain. The identity of the trypanosomes has been established by inoculation into various species of experimental animals, microscopic examination of living and stained specimens, and serum methods of diagnosis.

The author has found the human trypanosome to be inoculable for the monkey, dog, cat, rat, mouse, "huko" (a mole-like animal), guinea-pig, young leopard, and ngolombwe (a small antelope). With the exception of the last-named, all the infected animals died within a month. Only one strain of trypanosomes, found in a water-buck, was infective for the same experimental animals as the human strain. This was dimorphic, and intermediate forms were found. The long forms of the antelope strain were more active than the corresponding forms of the human strain, the movement appearing to be of one rapid vibration rather than a writhing one. In either case the movement involved little translation. In stained preparations marked displacement of the nucleus was observed in both strains. In the trypanosome found in the antelope the centrosome was frequently absent, but this was not observed in the human strain.

Cross immunity tests could not be carried out, but the activity of the serum was tested by LAVERAN and MESNIL'S method in a number of cases, and certain biological differences were found between the two strains. It may therefore be concluded that the two are not absolutely identical.

The trypanosomes found in a ngolombwe failed to infect a monkey, but infected a rat. Inoculation of further rats from this one failed; the trypanosome therefore could not be *T. rhodesiense*. The antelope was inoculated with blood from an infected man containing numerous trypanosomes. The trypanosomes previously present in the blood did not increase in numbers. Two monkeys and a dog were then inoculated from the antelope and infection took place.

The author therefore concludes that the human trypanosome was present in the antelope's blood.

The author's conclusions may be summarised as follows:

The trypanosomes found in game in the neighbourhood of Sasawara resemble those found in man, but present certain morphological and biological differences which make it impossible to consider the two as identical.

The human parasite can be experimentally transmitted to game, and from this it may be concluded that the transmission occurs in nature through the medium of tsetse flies.

Killing off the game as a means of combating the disease must be avoided, as it would have the effect of driving animals having a slight infection into clean districts where the conditions are suitable for *T. rhodesiense*, and lead to the infection of flies, man, and animals. If the game is to be killed off, the extermination would have to be complete, a measure which is in the author's opinion impracticable.

Human beings must be considered as the most important carriers of infection. The disease was probably brought in from Portuguese territory by natives, and medical examination must therefore be established in order to detect the disease in natives entering the colony.

(144) Beck (M.). **Untersuchungen über ein am Rovuma (Deutschostafrika) vorkommendes Trypanosoma beim Menschen.** [Investigations on a Trypanosome occurring in Man in the Rovuma District, German East Africa.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Feb. Vol. 18. No. 3. pp. 97-101. With 1 plate.

In 1911 and 1912 a number of small foci of sleeping sickness were discovered along the Rovuma and its tributaries which must have been due to the introduction of the disease from the neighbouring Portuguese territory. Seventy-two cases have been discovered.

The disease appears to be transmitted solely by *G. morsitans*, and 8 to 10 per cent. of the flies were found to be infected with trypanosomes. It was impossible to identify the trypanosomes found in the flies owing to the lack of experimental animals.

Experiments were undertaken to ascertain whether the trypanosome occurring in man was identical with *T. brucei*, as cattle had died of *brucei* infection in the district.

The posterior extremity of the human parasite usually has a loose structure and stains faintly. The anterior end is pointed, the nucleus is round and oval, and it was never observed to lie posterior to the blepharoplast. In a few cases it was close to the blepharoplast, but this is due in the opinion of the author to uneven drying of the cytoplasm. The lack of a micrometer eyepiece rendered it impossible to make any comparative measurements.

A strain of *T. brucei* was obtained from an infected mule, and comparative experimental inoculations with the human and animal strains shewed that the human strain was rather more virulent for the dog, monkey and rat than the animal strain.

In the animals infected with the human strain long forms first appeared in the blood, these were followed by intermediate forms, and then by short thick forms. Irregular rounded forms were observed in the blood of rats inoculated with blood containing the human parasite.

For further differentiation of the parasites, agglutination and agglomeration experiments were carried out. The results given by the former failed to reveal any distinction between the two. Cross-

immunity experiments were also undertaken, and these were successful to the extent that the trypanosomes did not appear in the blood of immunised rats (rats infected and then treated with atoxyl) until from 10 to 15 days after they had appeared in the blood of rats that had not been treated.

A number of animals were examined for trypanosomes in infected districts with the following results:

Of 8 dogs examined 5 were found to be infected. Three goats were all negative. Two water-bucks were positive out of three examined, and one of two elands also contained trypanosomes. A gnu, leopard, a spotted hyena and a number of monkeys and birds were negative.

(145) Duke (H. L.). **Wild Game as a Reservoir for Human Trypanosomes.**—*Brit. Med. Jl.* 1914. Feb. 7. pp. 289-292.

The author points out in the first place the great divergence of opinion held by observers engaged in the biological problems connected with sleeping sickness. The view held by the German investigators is that the game trypanosomes are not pathogenic for man, and that held by British investigators is that certain of the trypanosomes recovered from game are identical with *T. rhodesiense*.

Three years after the native population were moved from the islands and the lake shore of Victoria Nyanza, *G. palpalis* on the lake shore was capable of infecting monkeys with trypanosomes indistinguishable from *T. gambiense*, and an exactly similar trypanosome was recovered from the blood of two situtunga at about the same time or a little earlier. These animals were shot on Damba Island, a few miles from the mainland. The question arises whether the fly and the antelope trypanosomes are the descendants of the *T. gambiense* which was responsible for the epidemic, or are simply parasites of the antelope.

The author sets out his subject in the form of a number of questions and gives the available information upon which answers may be based.

With regard to the identity of the fly and the antelope trypanosomes, the author states that in a previous publication he has shewn that the identity cannot be doubted.

The evidence shews that the trypanosome of the fly is derived from the antelope and not from other sources.

Natives visiting prohibited areas are probably not the source of the infection of the flies and consequently of the antelope.

With regard to the question whether the lake-shore trypanosomes can be identified with *T. gambiense*, the answer is that while there is no good evidence to shew that the fly and the antelope trypanosome are not identical with *T. gambiense*, there is a certain amount of evidence to shew that they are.

Experiments shew that wild antelope of the species frequenting the lake shore are inoculable with the human trypanosome, and further that they are capable of acting as a source of infection for flies for 22 months at least, and probably longer.

The evidence on the subject of the infectivity of the wild fly to the wild-fly trypanosome is not so complete as could be desired, but it rather supports the view that the trypanosome of the wild fly is *T. gambiense* and not an antelope parasite.

There is no trypanosome known in Uganda possessing the animal reactions of the lake shore organism other than *T. gambiense.*

The percentage of antelope harbouring *T. vivax* and *T. uniforme,* that is, trypanosomes non-pathogenic for man, is slightly higher on the Island of Damba than on the mainland, 14·2 as compared with 10, but the natural conditions obtaining in two places are sufficient to account for this. The percentage of wild lake shore flies harbouring these parasites is about 0·1.

The author contends that the available evidence justifies the conclusion that the trypanosome recovered from the Damba situtunga and from the wild *G. palpalis* on the islands and on the coast of the mainland is a descendant of *T. gambiense.*

(146) Ciuca (A.). **Action des Abcès de Fixation sur la Trypanosomiase Expérimentale du Cobaye et sur son Traitement par l' Atoxyl.** [The Effect of Fixation-Abscesses upon the Treatment of Experimental Trypanosomiasis in the Guinea-pig and its Treatment with Atoxyl.]—*Ann. Inst. Pasteur.* 1914. Jan. Vol. 28. No. 1. pp. 6-20.

The author refers briefly to the observations of a number of authors regarding the beneficial effects produced by abscess formation in protozoal diseases (malaria, canine babesiasis, and sleeping sickness).

The investigation was undertaken by the author because in the cases referred to the abscess formation was of an accidental nature.

Essence of terebene is one of the chemical substances which is specially used for the production of fixation abscesses. The majority of the experiments have been carried out with the Uganda strain of nagana, as, according to the author, the course of the infection in the guinea-pig with this trypanosome is very constant, trypanosomes persisting in the blood from their first appearance up to the time of death. A further reason for using this trypanosome is that, according to Laveran and Thiroux's experiments, atoxyl alone is unable to effect a cure. In some of the experiments the guinea-pigs were infected with surra.

Ordinary commercial essence of terebene was used and it was injected subcutaneously on the outer side of the thigh, as high up as possible in order to avoid gangrene of the foot, and diffusion of the pus during abscess formation. The injection caused extreme disturbance which lasted for about half an hour. The resulting inflammation reached its maximum about the 72nd hour, abscess formation occurring about the 4th or 5th day. The pus was thick and of a dirty white colour. A strong odour of terebene could be detected even when the abscess was left for 10 days before opening. The susceptibility of the guinea-pig to the terebene varied greatly. In some there was marked loss of condition in 10 days, in others no effect of this kind was observed, and in some guinea-pigs no local inflammation would be produced.

The dose varied from 0·5 to 1 cc.

A freshly prepared solution of atoxyl in sterile distilled water was used, and the dose varied from 1·5 to 2 cc.

The disappearance of the trypanosomes from the circulation was frequently controlled by the inoculation of mice.

Forty-two guinea-pigs infected with Uganda nagana were used.

Eleven of these were controls and the remainder were treated either with terebene alone, or with terebene and atoxyl. Of ten guinea-pigs infected with surra, four were controls and the remainder were treated with terebene only.

The controls infected with the Uganda trypanosomes died in from 11 to 56 days, and those infected with surra in from 17 to 41 days.

Group A.—Guinea-pigs treated solely with essence of terebene.

Series 1. Guinea-pigs receiving one or more injections of terebene, the first being given at the time of infection in order to judge the effect upon the period of incubation.

Series 2. Guinea-pigs receiving a single injection of terebene when the infection was at its maximum.

In both of these series the two species of trypanosome were used.

The conclusions drawn from these experiments may be summarised as follows: The injection of the terebene at the same time as the infective inoculation prolongs the period of incubation by some days in the case of both trypanosomes. The injection of terebene when trypanosomes are most numerous in the blood causes a diminution in the number or, more frequently, a complete disappearance, commencing 24 to 48 hours after the injection. This is followed after an interval of about five days by a relapse. In spite of the severe experimental conditions, especially in the second series, the treated guinea-pigs frequently lived considerably longer than the controls.

Group B.—Guinea-pigs included in this group were inoculated intraperitoneally with the Uganda nagana strain and then treated with atoxyl and essence of terebene.

Series 1. Guinea-pigs receiving two injections of atoxyl and terebene. These were subdivided into two lots.

a. Those that received the first injection of terebene at the time of infection and the first injection of atoxyl when the trypanosomes were very numerous in the blood.

b. Those receiving simultaneous injections of terebene and atoxyl at the height of infection. As controls infected guinea-pigs treated with atoxyl and guinea-pigs which were left untreated were used.

Series 2. Guinea-pigs receiving several injections of terebene and atoxyl.

The dose of terebene used was 1 cc. in every case, and a fresh injection was only given when the abscess caused by one dose burst.

These guinea-pigs were also divided into two lots.

In the first lot the atoxyl injections were given every eight days in two doses of 0·015 and 0·02 g. at an interval of 24 hours. In the second lot the injections were given every five days, irrespective of whether the trypanosomes were present in the blood or not. The treatment was commenced two or three days after the appearance of trypanosomes in the blood. Controls similar to those of the first series were used.

The following is a summary of the conclusions drawn:

1. Atoxyl causes only a temporary disappearance of trypanosomes from the blood of guinea-pigs inoculated with the Uganda strain of nagana.

2. The injection of atoxyl in conjunction with abscess formation resulting from the injection of essence of terebene always produces a disappearance of trypanosomes from the blood which lasts for several days.

3. Repeated application of the combined treatment effects a complete disappearance of trypanosomes which lasts for a long time, but a complete cure is not effected.

4. Guinea-pigs weighing from 400-600 grammes can withstand twelve or thirteen injections, and possibly more, of atoxyl in doses from 0·015 to 0·02 g. More than 1 cc. of terebene must not be given at a dose, and the number of injections possible depends upon the emaciation produced.

The deaths of some of the treated animals before the controls may be ascribed to this.

5. Combined treatment appears to be superior to treatment with atoxyl alone. The terebene or the resulting abscess formation probably facilitates the formation of trypanotoxyl.

6. The method should be tried upon large animals in which abscess-formation does not produce so marked a debilitating effect.

(147) Kolle (W.), Hartoch (O.) & Schürmann (W.). (i) **Weitere Mitteilungen über chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** [Further Chemotherapeutic Experiments in Connection with Trypanosome Infections.]—*Deut. Med. Wochenschr.* 1914. Jan. 29. Vol. 40. No. 5. pp. 212-214.

(148) (ii) **Chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** ii. **Mitteilung.**—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Jan. 22. Vol. 20. No. 5. pp. 436–475.

i. The authors reaffirm their statement published previously, to the effect that compounds of pentavalent antimony are practically useless for the treatment of trypanosomiasis.

Their experiments with Trixidin (antimony trioxide) upon large animals did not yield the satisfactory results obtained with small laboratory animals. Rabbits, dogs, and monkeys were used, and the intramuscular injection of trixidin lead to abscess formation. In a few cases, however, injections into rabbits were not followed by any untoward complications.

With the object of trying to avoid this, a number of substances were added to the trixidin suspension (in oil), but without success. The distribution of the injections over the body also failed to prevent abscess formation.

They succeeded however in administering the drug intravenously in salt solution, and they were able to cure rabbits infected with dourine by one or two injections.

By a special process it was found possible to get the antimony trioxide into a sufficiently fine state of division to permit of its being used for intravenous injection. At the same the drug presented a greater effective surface.

The good results obtained with commercial antimony trioxide are improved upon by the use of the drug in a more finely divided form, but results are not yet ready for publication. An attempt was made to treat horses infected with dourine by means of intramuscular injections, but, as in the case of the rabbits, abscess formation resulted.

Ostertag reports to the authors that good results have been obtained with naturally infected cattle in East Africa. Information is not given as to how the treatment has been carried out in this instance. Up to the time of writing (2 months) the treated cattle had remained free from trypanosomes.

Trixidin has been found to be capable of protecting animals against infection for a period of several weeks.

The method of making a salve either with metallic antimony or with insoluble organic compounds has been used successfully. No toxic effects have been produced.

Dimethyl-phenyl-pyrazalon-antimony-trichloride salve and intramuscular injections of trixidin are said to have a marked effect upon sleeping sickness in man, but abscess formation results from the latter treatment. No experiments have as yet been carried out using the intravenous injection method.

Conclusions :—

1. Trixidin effects a cure in the case of large animals affected with chronic trypanosomiasis.

2. In cases in which intramuscular injections of trixidin lead to abscess formation, infected rabbits and guinea-pigs can be cured by intravenous injections—antimony trioxide in salt solution.

3. A lasting cure can be effected in the case of dogs suffering from chronic dourine by the injection of antimony compounds, and particularly of dimethyl-phenyl-pyrazalon-antimony-trichloride (Scheitlin).

4. The principle advocated by us (involving the use of insoluble compounds of antimony or the inunctions) can also be applied to the human subject, but at the moment abscess formation precludes the subcutaneous or intramuscular injection of antimony trioxide.

5. Antimony trioxide can be obtained in a form resembling the colloidal form by a special process, and this can be used with great success for intravenous injection into small animals.

6. Further investigation is required to see whether colloidal antimony trioxide can be used for the treatment of sleeping sickness in man, or as an adjuvant in a combined treatment.

ii. This paper contains a fuller and more detailed account of the above experiments.

(149) Moldovan (J.). **Ueber die Wirkungsart des Atoxyls, Salvarsans und des Menschenserums bei der experimentellen Naganainfektion.** [The Nature of the Action of Atoxyl, Salvarsan, and Human Serum in Experimental Nagana.]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 481-519.

The author's experiments lead him to conclude that atoxyl acts directly upon the trypanosomes, and that the body cells, phagocytes, and other defensive powers of the body do not intervene. The atoxyl is absorbed by the trypanosomes and the toxic substance is formed in their own bodies. The animal body is necessary only in so far as it renders a multiplication of the parasites possible, involves an increase in metabolism, and leads to the absorption of substances and the production of toxic materials. In vitro the parasites are indifferent owing to their low vitality.

The property of being atoxyl-fast appears to depend not only upon absorption not taking place or the atoxyl not being reduced, but also upon the insusceptibility of the trypanosomes to the toxic products. The same holds good for salvarsan and human serum.

(150) Lurz (R.). **Versuche mit dem Trypanosomenheilmittel "Trixidin" bei schlafkranken Menschen.** [Experiments with Trixidin in the Treatment of Sleeping Sickness in Man.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1914. Mar. Vol. 18. No. 6. pp. 212-213.

Trixidin is a 30 per cent. emulsion of antimony trioxide in oil, and it is credited with effecting a permanent cure in small animals infected with trypanosomes in 100 per cent. of cases.

Seven persons infected with sleeping sickness, but shewing no clinical symptoms save swelling of the glands, were put under treatment. Two intramuscular injections were given, the doses varying from 0·1 to 0·3 grammes, and the injections being given at an interval of two days. The injections were made into the buttocks.

The injections were followed by severe abscesses, fever, pain, loss of sleep and appetite, and the patients lost condition. Seven days after the second injection the abscesses were opened and a large quantity of pus and unabsorbed emulsion escaped. The abscesses healed slowly.

The glands did not decrease in size after the trixidin injections, and though in three cases trypanosomes disappeared from the blood and the glands, they could be found in the cerebro-spinal fluid.

The author concludes that the drug is not suitable for the treatment of sleeping sickness.

(151) Danysz (J.). **Essais de Chimiothérapie. Combinaisons des Sels d'Argent et des Composés arsenicaux dans le Traitement des Trypanosomiases Expérimentales et de la Syphilis chez l'Homme.** [Chemotherapeutic Experiments. Combinations of Silver Salts and Arsenic Compounds in the Treatment of Experimental Trypanosomiases and of Syphilis in Man.]—*Ann. Inst. Pasteur.* 1914. Mar. Vol. 28. No. 3. pp. 238-256.

The following is an abstract of that portion of the paper which deals with the author's investigations in connection with experimental trypanosomiasis.

In the majority of the experiments the trypanosome of surra was used. Control mice inoculated subcutaneously died as a rule on the fourth or fifth day.

The following compounds were used and for the sake of brevity the author uses symbols given in brackets to designate each :

Dioxydiaminoarsenobenzol chlorargent-argentate (ACA).
Dioxydiaminoarsenobenzol bromo-argentate (ABA).
Dioxydiaminoarsenobenzol iodo-argentate (AIA).
Dioxydiaminoarsenobenzol (ddab).

All the mice received a single injection of one or the other of these drugs on the third day of infection, when trypanosomes were numerous in the blood.

It was found that " ABA " was distinctly more active than " ACA " and " AIA."

The dose which will cure a mouse by injection 60 hours after infection may be placed at 0·07 mgm. The maximum therapeutic dose is 2·5 mgm. The drug is therefore three times as active as " ddab " and 35 times as active as atoxyl.

In view of this fact " ABA " was principally used in subsequent experiments.

The objects of the further experiments were to ascertain the effects of treatment undertaken at earlier and later stages of infection, the effects of repeated small doses which if given as a single dose do not prevent relapses, and to investigate the treatment of relapses.

The experiments lead the author to conclude that (1) recovery can be effected with more certainty and with smaller doses the sooner treatment is undertaken after infection ; (2) the administration of a number of small doses is more effective than that of a single large dose.

The dose required to effect a cure when trypanosomes were already numerous in the blood was five or six times that required if administered during the first 24 hours after infection.

In the treatment of relapses the same facts are to be observed as in the treatment of primary infections, with the difference that there are parasites present in the body which are more or less resistant to the action of the drug. Thus the line of treatment indicated is to give several doses at fairly short intervals.

The point is emphasised that the drugs play in reality a secondary part in the destruction of the parasites, the primary part being played by the defenses of the body which are stimulated by the drugs.

Comparative experiments shewed that " ABA" is as active against *T. rhodesiense* and *T. gambiense* as against the trypanosome of surra.

Mice infected with *T. rhodesiense* have been cured by a single injection of 1 mgm. of " ABA," and by 0·04 mgm. when combined with trypanred.

Doses of 1 mgm. and even 2 mgm. of " ABA " only delayed death for a few days in the case of mice infected with *T. dimorphon*. Mice infected with this trypanosome were, however, cured by a mixture of 3 mgm. of " ACA," 2 mgm. of " ABA," and 1 mgm. of trypanred. In another instance 1 mgm. of " ABA " with 1 mgm. tryparosan effected a cure.

The drug " ACA " was found to be far more effective than " 606 " in the treatment of avian spirillosis.

(152) Danysz (J.). **Traitement du Surra par les Composés Arsenicaux et Arséno-Argentiques. Rapports entre les Doses Tolerées et les Doses Curatives.** [The Treatment of Surra with Arsenic and Arsenic-Silver Compounds. The Relationship between the Maximum Safe Doses and the Curative Doses.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 200-202.

Mice infected with surra can be cured by various arsenic and arsenic-silver compounds, and in particular by atoxyl, arsenophenylglycin, chlorhydrate of dioxydiaminoarsenobenzol, and the sulphate of bromoargentic dioxydiaminoarsenobenzolate.

The author carried out a number of experiments with the object of ascertaining the ratios of the maximum dose tolerated to the dose sufficient to effect cures by a single injection.

The following ratios were established :
Atoxyl 1 : 1.
Arsenophenylglycin 3 : 1.
Chlorhydrate of dioxydiaminoarsenobenzol 8 : 1.
Sulphate of bromoargentic dioxydiaminoarsenobenzolate 35 : 1.
A number of experiments have shewn that the last drug, which the author terms " 88d," can be injected repeatedly without ill effect.

(153) Frosch (P.) & Knuth (P.). **Steigerung der Wirkung des Salvarsans durch Combination mit Optochininum hydrochloricum und Natrium salicylicum bei künstlicher hervorgerufenen Trypanosomenkrankheit der Pferde.** [Increase in the Activity of Salvarsan in Experimental Trypanosomiases in the Horse through Combination with Hydrochloride of Optoquinine and Sodium Salicylate.] —*Berlin. Tierärzt. Wochenschr.* 1914. Feb. 19. Vol. 30. No. 8. pp. 133-134.

The strains used were nagana ' ferox ' and von Prowazek's strain. These proved fatal to horses in every case within two or three months after inoculation. In the earlier experiments salvarsan was administered in increasing doses, until doses of 7 grammes were given two consecutive days, but without result. The trypanosomes were found to be arsenic-fast when they re-appeared in the blood. The use of salvarsan combined with quinine hydrochloride yielded no results.

Optoquinine is aethylhydrocuprein, and was introduced into practice by Morgenroth, at whose suggestion the authors employed the drug.

Seven horses were under treatment. The earlier experiments were directed towards ascertaining the effective dose and the best time for the administration. Horse 4, was treated 42 days after infection, Horse 7, nine days, and Horse 6, five days. Horse 8, received protective treatment 5 days before infection, and this was repeated 35 days after infection. Subsequent experiments shewed that the doses used in these experiments were small.

Horse 4.—Trypanosomes disappeared from the circulation rapidly, and on the sixth and seventh days the treatment was repeated, trypanosomes remaining absent from the blood. Unfortunately the animal died from tetanus 17 days later.

Horse 7.—Seventeen days after treatment a relapse occurred, and in spite of energetic treatment others followed, and the animal was destroyed.

Horse 6.—Died on the 15th day after treatment from colic. Trypanosomes had disappeared from the blood.

Horse 5.—Treated on the 15th day after infection. Trypanosomes disappeared from the peripheral blood, and the animal remained free from trypanosomes for four months. The cure was not complete, as relapses occurred which energetic treatment failed to arrest.

Fresh experiments were undertaken with two further animals, Nos. 9 and 11.

In these cases the doses were greatly increased and the method modified. Horse 11, received a single treatment, and No. 9 was treated twice with an interval of three days.

No. 11 was treated on the 6th day after infection and No. 9 on the 7th day. Up to the time of writing (2½ months) the animals had

remained free from trypanosomes and inoculation of their blood into mice has failed to cause infection.

A fuller report was to be made at the Congress of Tropical Medicine at Berlin in April.

(154) WALKER (G. K.). **The Arsenical Treatment of Surra in Horses; Records of Four Cases.**—*Jl. Comp. Path. & Therap.* 1914. Mar. Vol. 27. No. 1. pp. 71-75.

The treatment followed was that described by HOLMES in 1909 in the *Journal of Tropical Veterinary Science*. The animals treated were experimentally infected, and the control animal from which the treated animals were inoculated, and which had been inoculated from an infected dog, died on the 34th day after trypanosomes first appeared in the blood. Death occurred rather sooner than was expected, but the animal was old and weak.

Detailed descriptions of the courses of treatment given in the four cases are described. In general, the treatment consisted in a subcutaneous injection of atoxyl of 100 cc. of a 4 per cent. solution, followed by the administration *per os* of from 1·5 to 2·5 gm. of arsenious acid given in bolus. There was an interval of a day between the doses. In the first case the treatment was not well tolerated and the animal undoubtedly died from arsenical poisoning. The other three cases received full sub-toxic doses, but the trypanosomes were not destroyed, and reappeared in each case after two courses of treatment.

In the first case trypanosomes appeared in the blood during the first course of treatment only.

(155) UHLENHUTH (P.) & SEYDERHELM (R.). **Experimentelle Untersuchungen über den Einfluss elektrischer Schwachströme auf Trypanosomen** *in vitro* **und** *in vivo.* [Investigations of the Effect of Electric Currents upon Trypanosomes *in vitro* and *in vivo.*]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol. 21. No. 1/5. pp. 366-377.

A suspension of blood containing *T. equiperdum* was made in salt solution and a current of 15 milliampères was passed through it. The trypanosomes were killed in 10–20 minutes. Before death occurred, the trypanosomes shewed an exaggerated motility. *T. lewisi* was found to offer more resistance to the effect of the electricity than the strain of *T. equiperdum* with which the experiments were carried out. A sub-lethal quantity of electricity reduced the infectivity of the trypanosomes.

Trypanosomes which had been destroyed by the electric current were found to be toxic for mice.

In their experiments with infected animals the authors ascertained the following facts:

If a tourniquet be applied to the leg of an infected rat and the current be passed through the limb, all the trypanosomes are killed. The application of the non-polarisable electrodes for 15 minutes daily to the abdomen and back of a mouse having trypanosomes in its blood caused an almost complete disappearance of the trypanosomes, but after the cessation of the application of the current trypanosomes returned and the infection followed a normal course.

(156) HENNINGFELD (Fr.). **Ueber die Isolierung einzelner Trypanosomen.** [The Isolation of Single Trypanosomes.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Mar. 21. Vol. 73. No. 3. pp. 228-240.

The author found LINDNER'S method of isolating yeasts impracticable for the isolation of trypanosomes, but succeeded with the capillary tube method of FROSCH. The tubes used had a lumen of ·018 mm. and the glass was ·006 mm. in thickness. A number of different liquids,—broth, salt solution, and the sera of different animals were used to dilute the blood containing the trypanosomes. This diluted blood was drawn into the tube. The tube was examined with an objective of either low or moderate power and a high eyepiece. When a trypanosome was found an object marker provided with a grease pencil was used to mark the portion of the tube containing it. The tube was then cut so as to obtain this portion. Some practice was necessary to acquire sufficient dexterity and speed.

Working with *T. brucei* and *T. equiperdum*, the author found that the parasites retained their vitality longer when the capillary tube method was used than when LINDNER'S method was employed. The proportion varying from 1½ to 3 times. Trypanosomes retained their vitality best when serum was used as the diluting fluid. In spite of the fact that in serum dilutions in capillary tubes the trypanosomes retained their vitality for as long as 23 hours, no multiplication of the parasite was observed in any instance.

A few control experiments shewed that when no moving trypanosomes were discoverable in the diluted blood the mixture was not infective for experimental animals.

In three experiments the placing of the fragment of capillary tube containing a single trypanosome under the skin of mice failed to set up infection.

OEHLER'S method of drawing the fragment of capillary tube into a syringe containing 1 cc. of salt solution was also tried on two occasions, but failure to infect resulted.

The author found it an advantage to use serum as a diluent and to have serum in the syringe for injection of the tube into the abdomen. He also found it an improvement in the method to push the piece of tube into the needle (dry) of the syringe instead of sucking it up with a small drop of liquid. Working in this way the author was able to obtain 70 per cent. of successes.

(157) LUNDIE (A.). **The Detection of Trypanosomes in Animals.**—*Jl. Trop. Med. & Hyg.* 1914. Jan. 15. Vol. 17. No. 2. p. 22.

The author has found the following method to yield good results where plenty of blood is available.

Tubes containing 5 grammes of potassium citrate dissolved in 5 cc. of sterile water are prepared and sterilised. The blood is allowed to run direct into the tubes, which are then set aside in the vertical position. Within half an hour there is always a little clear liquid at the top, and if trypanosomes are present in the blood at all, they will be found there.

The method is said to yield a larger number of positive results than any of the other methods known to the author.

Another advantage claimed for the method is, that it can be used for the study of trypanosomes. The tubes are left until the corpuscles have settled (three days) and the clear liquid is pipetted into a fresh sterile tube. The author has frequently obtained crithidial forms in this way.

It is also said that the life history of trypanosomes in tsetse flies can be studied by imitating the conditions present in the stomach of the fly. This is done by adding hydrochloric acid to make 0·2 per cent. strength. The effect is to convert the blood into a brown jelly. "The addition of a digestive ferment would no doubt complete the culture medium quite successfully. The matter of temperature is simple as the fly cannot possibly incubate its undigested blood at a temperature higher than that of the air. Experiments in this direction promise a certain amount of success and are certainly different from what have hitherto been in vogue."

(158) Marullaz (M.). **Contribution à l'Étude des Trypanosomes des Oiseaux, Deux Espèces Nouvelles.** [The Trypanosomes of Birds. Two New Species.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 115-117. With 2 text-figs.

Trypanosoma lagonostictae. This parasite was found in smears from the liver and lungs of *Lagonosticta senegala.* The parasites were not seen in the fresh blood, the bird dying two days after arrival at the laboratory in Paris. Only one type of trypanosome was found. The parasites are somewhat stumpy, measuring 22 to 25 microns in length, including the free flagellum of 2 to 3 microns, and 5 to 7 microns in width. The body terminated posteriorly in a sharp point. The nucleus measured about 3 microns. The centrosome is very distinct and the cytoplasm slightly granular. In the anterior portion the granules form four or five very distinct rows converging towards the anterior end of the body. The trypanosomes were very scanty in the preparations from the lungs and liver, and none were found in the spleen.

Trypanosoma liothricis. A single trypanosome of this species was found in the blood of the bird during life, and none were found in films from the organs and bone marrow after death. Cultures were made from the heart blood and trypanosomes developed rapidly. In the cultures small forms measuring 21 by 4·5 microns, intermediate forms measuring 30 by 3, large stumpy forms measuring 34 by 6, and long slender forms measuring 42 by 2 microns were found. Large refractile granules could be seen in the cytoplasm in fresh preparations, but these disappeared after fixation with alcohol and ether, and were replaced by vacuoles in specimens stained with Giemsa.

In stained preparations variable numbers of chromatophile granules could be found, particularly in the anterior portion of the body. The nucleus and centrosome stained well. Crithidial forms were by far the most numerous.

Inoculation of four other birds of the same species failed to set up infection.

LEISHMANIASIS.

(159) Wenyon (C. M.). **The Culture of Leishmania from the Finger-Blood of a Case of Indian Kala Azar, with some Remarks on the Nature of Certain Granular Bodies recently described in this Disease.**—*Jl. Trop. Med. & Hyg.* 1914. Feb. 16. Vol. 15. No. 4. pp. 49-51.

Six tubes of NNN medium were inoculated with 2 to 3 drops of blood taken from the finger of a patient in whom leishmania had been found by liver puncture.

Repeated examinations of the blood had failed to reveal the parasite. On the 6th and 11th days the tubes were negative (one was contaminated), but on the 18th day flagellated forms were found in the other five.

This demonstrates the possibility of the invertebrate host becoming infected from peripheral blood. The author states that it is now a fairly common experience in animal experiments to obtain cultures from organs in which the parasite has not been detected microscopically.

The question arises whether such cultures result from some stage of the parasite hitherto unrecognised, or from leishmania which are present in numbers that are too small to permit of recognition by microscopical examination.

On a number of occasions the author has encountered the protoplasmic masses containing purple-staining granules described by Archibald, Statham and Butler, and Smallman in smears obtained by liver puncture in animals. As a control to these bodies, uninoculated animals were examined by the same procedure and exactly similar bodies were found, thus doing away with any view that they may be connected with leishmania. The author is convinced that the bodies are merely detached portions of cytoplasm from large cells which are themselves charged with granules.

(160) Mayer (M.) & Werner (H.). **Kultur des Kala-Azar-Erregers (*Leishmania donovani*) aus dem peripherischen Blut des Menschen.** [The Cultivation of the Cause of Kala Azar (*Leishmania donovani*) from the Peripheral Blood of the Human Subject.]—*Deut. Med. Wochenschr.* 1914. Jan. 8. Vol. 40. No. 2. pp. 67-68.

The authors found parasites in tubes of NNN medium a month after they were inoculated. About a dozen tubes were used, eight of which became contaminated; but the remaining five yielded positive results. Subcultivation was also successful.

The examination of 12 smears of the blood used as seed material failed to reveal the parasite. From three to five drops of blood were used for the inoculation of each tube. This the authors calculate would have been sufficient for from 36 to 60 film preparations.

A further series of culture tubes inoculated about a month after the first failed to develop any growth.

(161) Pringault (E.). **Existence de la Leishmaniose canine à Marseille.** [The Existence of Canine Leishmaniasis at Marseilles.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 41-42.

The author has discovered one case out of 50 dogs examined. The

animal was in very poor condition, but it was not possible to make a post-mortem. The method of examination was trephining the femur. Parasites were numerous in the marrow.

(162) LAVERAN (A.). **Au Sujet d'un Cas de Leishmaniose canine signalé à Marseille.** [Regarding the Case of Canine Leishmaniasis reported from Marseilles.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 173-174.

Laveran points out that as Marseilles is in daily communication with places in which canine leishmaniasis is known to occur, and since nothing is known regarding the history of the dog, it is quite likely that the animal contracted the infection elsewhere. He thinks that it would be a valuable protective measure to prohibit the importation of dogs from countries where either the canine or infantile form of the disease exists.

(163) YAKIMOFF (W. L.) & SCHOKHOR (N. I.). i. **Recherches sur les Maladies tropicales humaines et animales au Turkestan.** (1) **Répartition de la Leishmaniose canine au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (1) The Distribution of Canine Leishmaniasis.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. p. 185.

(164) ii. **Recherches sur les Maladies tropicales humaines et animales au Turkestan.** (2) **La Leishmaniose cutanée (Bouton d'Orient) spontanée du Chien du Turkestan.** [(2) Cutaneous Leishmaniasis of the Dog in Turkestan.]—*Ibid.* pp. 186-187. With 1 text fig.

i. The authors have examined 647 dogs and have found 157, or 24·26 per cent., infected. They have also encountered 31 cases in man (27 in children and 4 in adults).

ii. After mentioning the previous publications regarding the occurrence of this condition in natural circumstances, and its experimental production, the authors briefly describe a case which came under their own observation. The dog was in a very poor condition, had lost a great part of its coat, and had a purulent discharge from its eyes. On its back there was an ulcer measuring 7 by 5 mm. (microns according to the text), and a slightly larger one on the right side of the neck. The bases of the ulcers were covered with red granulations, in preparations from which, stained with Giemsa, typical parasites were found. Several were very large, measuring 7·85 by 2·35 microns.

The authors recall the fact that the parasites present in cases of oriental boil in Turkestan are according to their own observations: *Leishmania tropica* var. *minor* (Bukhara) measuring 3·92 by 3·14 microns, and *L. tropica* var. *major* (Termese), 5·49 by 3·92 microns. They suggest the name *L. tropica* var. *canina* for the sub-species.

(165) LEMAIRE (G.), SERGENT (Ed.), & LHÉRITIER. **Spécificité de la Kératite observée chez les Chiens atteints de Leishmaniose naturelle.** [The Specific Nature of the Keratitis observed in Natural Cases of Leishmaniasis in the Dog.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 193-196.

The authors attach great importance to the keratitis observed in

natural cases of leishmaniasis, and histological examination of the cornea from an infected dog has revealed an interstitial keratitis associated with the presence of parasites. The following alterations were found in the invaded cornea : The anterior epithelium may shew slight thickenings and desquamation at places, but there is no actual ulceration. Immediately beneath the epithelium there are masses of cells and newly formed blood-vessels.

At first sight it appears as if the cornea were composed of stratified layers separated from each other by one or more layers of cells, or by a richly cellular exudate.

The exudate is most abundant in the middle portion of the cornea, where the laminae are separated off into fine fibrils. Lymphocytes containing parasites are to be found in the cellular groups.

The posterior membrane of the cornea is clearly visible. Descemet's membrane is thickened and irregular owing to the presence of rounded cells and large cells containing parasites. With the increasing duration of the lesion the exudate disappears and the corneal laminae undergo a process of fibrosis.

The authors have not been able to find any evidence of secondary infection, and they are convinced that the lesion is specific.

This fact is of great value from the point of view of diagnosis, and even for a retrospective diagnosis, for the reason that a more or less marked opacity is left in cases where recovery takes place spontaneously.

SPIROCHAETOSIS.

(166) von Ratz (S.). **Spirochaetose des Geflügels.** [Avian Spirochaetosis.]—*Berlin. Teirärzt. Wochenschr.* 1914. Feb. 12. Vol. 30. No. 7. pp. 117-119.

The author records an outbreak of spirochaetosis among fowls, geese, and ducks upon a farm in Hungary. Blood from a fowl received within 48 hours after death set up an infection in one of two fowls inoculated subcutaneously. Spirochaetes appeared in the blood, but subsequently disappeared and the bird recovered.

A diseased duck was despatched alive to the Institute (Budapest), but died before arrival. Spirochaetes could be found in very small numbers in the blood, but it failed to infect fowls by inoculation. The occurrence of the disease in three species of birds simultaneously suggests that *S. gallinarum* and *S. anserina* are identical.

(167) Gonder (R.). **Experimentelle Studien über** *Spironema gallinarum* **und** *Spironema recurrentis*. [Experimental Studies regarding *Spironema gallinarum* and *Spironema recurrentis*.]—*Zeitschr. f. Immunitätsforsch. u. experim. Therapie.* Orig. 1914. Mar. 14. Vol 21. No. 1/5. pp. 309-325.

In a previous paper the author shewed that *T. lewisi*, if arsenic-fast, loses that property when it passed through the natural intermediate host, the rat louse. The same does not hold good for *S. gallinarum*. A strain of fowl spirochaetes which is arsenic-fast retains that property when it is passed through other birds and back into fowls.

The author was able to compare the Soudanese and Brazilian strains of fowl spirochaetes. He found that whereas the Soudanese strain protected against the Brazilian strain the converse did not hold good.

In a few experiments the author obtained the somewhat surprising result that an immune fowl can be reinfected if the spirochaete be passed through a Java sparrow, and conversely an immune Java sparrow can be reinfected after the spirochaete has been passed through a fowl.

(168) Launoy (L.) & Lévy Bruhl (M.). **Evolution de la Spirillose chez la Poule, après Splénectomie.** [The Evolution of Spirillosis in the Fowl after Splenectomy.]—*Compt. Rend. Soc. Biol.* 1914. Feb. 27. Vol. 76. No. 7. pp. 298-299.

Splenectomy is a somewhat difficult operation to perform on the fowl owing to the deep position occupied by the organ. When it is successfully accomplished recovery is complete in from 8 to 10 days, and no disturbance of health is observed.

In a general way the disease follows its normal course in fowls deprived of the spleen, but spirilla appear in the blood sooner than in normal fowls. They may be observed as early as 18 hours after inoculation, while in controls they make their appearance in about 48 hours. Further points are, that spirilla are constantly more numerous in the blood, and two crises occur. The septicaemic stage lasts longer in animals deprived of the spleen than in control animals. It commences 24 hours earlier, and terminates 24 to 48 hours later. There is, however, no increased severity of the disease from the clinical point of view, and in some cases the symptoms of intoxication, dullness, and paralysis are less marked and even unobserved in birds from which the spleen has been removed. This is possibly explained by the view that owing to the absence of the spleen destruction of the spirilla and liberation of toxic substances does not occur to nearly so marked a degree.

Antibodies are produced as in control birds, and the same blood reactions—rapid anaemia, leucocyte variations etc.—occur as in normal fowls.

(169) Arnheim (G.). **Spirochaetenuntersuchungen.** [Investigations regarding Spirochaetes.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1914. Jan. Vol. 76. No. 3. pp. 407-441. With 2 plates.

The bulk of this article consists in a description of the author's investigations of the spirochaetes which are responsible for disease in the human subject, but a short section is devoted to the question of the relationship between spirochaetes and swine fever.

Recently King, Baeslock, and Hoffmann have described a spirochaete as being the cause of this disease. The parasite has been found by these authors in the blood and in the intestinal ulcers, and from this they have concluded that the organism and the disease are causally connected. Opposed to this view are the facts that none of the species of spirochaetes discovered up to the present are capable of passing through filters, and further that salvarsan, which is a specific

for spirochaete infections, is ineffective in swine fever. The author carried out a number of transmission experiments with several strains of the virus. Small thick spirochaetes with a few turns were present in the virus, and spirochaetes were discoverable in the blood withdrawn from the caudal artery, but they were not discoverable in the heart blood. They were always present in very small numbers. They were present in the intestine, and at places where there were no diphtheritic lesions. Spirochaetes were also obtained by cultural methods from the mesenteric glands of an infected pig, but the author came to the conclusion that they were derived from the intestine and had nothing to do with the disease.

TOXOPLASMOSIS.

(170) SARRAILHÉ (A.). **Notes sur la Toxoplasmose Expérimentale.** [Notes on Experimental Toxoplasmosis.]—*Bull. Soc. Path Exot.* 1914. Mar. Vol. 7. No. 3. pp. 232-240.

This paper contains the author's observations upon the resistance of *Toxoplasma gondii* outside the body when placed in sterile media and exposed to temperatures between 0° and 37° C., or under the action of various injurious physico-chemical conditions, such as heating to temperatures higher than 40° C., and the effect of distilled water. The effects produced by certain heterologous sera have been investigated in order to ascertain whether they prevent or delay the multiplication of the parasite in susceptible animals. The coefficient of infectivity of the parasite for animals by various methods of infection with very weak dilutions of the virus in physiological salt solution has also been investigated.

In connection with the first of these points it was found that incubation at 37° C. destroys the vitality of the parasite in 24 hours. Maintenance at laboratory temperature for 17 days did not destroy the infectivity of the virus.

In a previous paper the author, in conjunction with MESNIL, stated that the parasite remains living and virulent in carcasses 30 hours after death.

In a new series of experiments it was found that the serous peritoneal exudate of a mouse dead 50 hours previously and swarming with bacteria proved fatal to mice by intraperitoneal inoculation. Exudate withdrawn 80 hours after death failed to set up infection.

It having been found that 24 hours' exposure to a temperature of 37° C. killed the virus, the effect of higher temperatures for shorter periods was investigated.

A quantity of peritoneal exudate was drawn into a pipette and incubated at 45° C. Mice were inoculated at half an hour, one hour, and two hours with this material. All died, but the period elapsing between inoculation and death was increased to 8 days in the first case and 11 days in the last. Control mice died in 5 days.

As the peritoneal fluid was very viscous and contained coarse particles which might assist the parasites in resisting the temperature, pleural fluid, which was much clearer, was used.

A control mouse inoculated with unheated exudate died in 7 days, and two mice inoculated with virus heated for 2 hours at 45° C. died in 13 and 15 days. Peritoneal exudate was mixed with an equal quantity of physiological salt solution, the pipette being kept in a vertical position for an hour. It was then incubated for 2 hours at 45° C. The upper clear liquid and the turbid liquid were each inoculated into two mice. The mice inoculated with the clear liquid died in 7 and 9 days, and those inoculated with the turbid liquid in 7 and 10 days. The control mouse died on the 5th day. Heating either undiluted exudate or a 10 per cent. solution of exudate to 48·5° for two hours was sufficient to destroy the infectivity of the parasite. Similar results were obtained when the temperature was 50° and 52·5° C. In all these cases the mice which failed to become infected with the heated virus were shewn to be susceptible and to have acquired no immunity by a subsequent inoculation with fresh virus.

The following mixtures were injected into mice :

Pure virus drops.	Physiological salt solution drops.	Distilled water drops.
1	10	0
1	9	1
1	7	3
1	5	5
1	3	7
1	1	9
1	0	10

The mixtures were allowed to stand for 5 minutes before being used for the intraperitoneal inoculation of the mice.

The mice inoculated with the first three mixtures and the control mouse died in 5 days. The remaining mice died in 6 days.

A mixture containing 1 drop of virus in 12 drops of distilled water allowed to stand for 15 minutes before inoculation failed to set up infection.

The addition of human serum, serum from a cynocephalus, and from a rat, to the virus failed to prevent infection.

The addition of serum from an infected dog to the virus failed to prevent infection when the mixture was inoculated into mice, even though comparatively large quantities of serum were used.

A virus diluted 1 in 100,000 in salt solution was capable of infecting mice.

A mouse inoculated into the nasal fossae with a few drops of a 1 per cent. solution of virus in physiological salt solution contracted a fatal infection, and died in 10 days.

Two drops of a 1 per 100,000 dilution instilled into each eye of a mouse failed to set up infection. Negative results followed the introduction of this dilution into the nasal fossae and vagina.

As the author has very seldom found the parasite in circulating blood, he withdrew blood from the heart of an infected mouse, mixed it with citrate solution and used doses of 1, 5, and 15 drops for the intraperitoneal inoculation of three mice. All three died, in 10, 9, and 8 days respectively.

(171) Carini (A.) & Maciel (J. J.). **Infections de Toxoplasmose et de Paralysie Bulbaire Infectieuse par les Muqueuses Saines.** [Infections with Toxoplasmosis and Infectious Bulbar Paralysis by Way of Healthy Mucous Membranes.]—*Bull. Soc Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 112-114.

This paper contains a brief statement to the effect that the authors have transmitted infectious bulbar paralysis to the rabbit by placing in the conjunctival sac a few drops of blood or tissue-extract from an infected animal.

They have also been able to infect pigeons by smearing the buccal mucous membrane with material containing large numbers of toxoplasms, and also by placing similar material on the eye.

PROTOZOA.

(172) Laveran (A.) & Marullaz (M.). **Sur deux Hemamibes et un Toxoplasme du *Liothrix luteus*.** [Two Haemamoebae and a Toxoplasma of *Liothrix luteus*.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 21-25. With 1 text fig.

Of seven birds (*Liothrix luteus*) purchased in Paris three shewed haemamoebae apparently belonging to two different species; two had haematozoa of the toxoplasma type, and in one a trypanosome was found.

The smaller of the haemamoebae appeared to be of the *H. relicta* type (*Proteosoma*), and the larger of the *H. ziemanni* type.

The authors propose *H. tenuis* as the name for the former and *H. liothricis* for the larger.

The toxoplasma found closely resembles that of the sparrow and padda, and the authors suggest the name *Toxoplasma liothricis* for it.

(173) Galli-Valerio (B.). *Smithia talpae* **n. sp. (Piroplasmidae) chez** *Talpa europaea* L. [*Smithia talpae* n. sp. in the European Mole.] —*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Feb. 25. Vol. 73. No. 2. pp. 142-143. With 1 text-fig.

The parasite described in this paper was found in the blood of a mole received from Malleray (Tavannes Valley, Jura).

Parasites were scanty in smears made from the blood, but possibly this was due to the fact that the blood was coagulated. Specimens stained badly both with Leishman and Bram's azur, although they were stained for 24 hours.

All the parasites were contained in red corpuscles, and two forms were observed: 1. Long pear-shaped parasites measuring from 3 to 4½ microns in length by 1 to 2 in width. The cytoplasm stained faintly blue and the chromatin was disposed at the thicker pole. 2. Round or oval bodies situated for the most part at the periphery of the corpuscles. Single parasites only were found in the corpuscles. The chromatin formed a single small mass placed at the periphery of the parasite or was in the form of a row of minute granules. The parasites measured from 1·5 to 2 microns in diameter. No multiplication forms were observed.

(174) Behrend (K.). **Kurze Angaben über eine nichtpathogene Amöbe aus dem Darm von** *Macacus rhesus*. [A Short Description of a Non-Pathogenic Amoeba from the Intestine of *Macacus rhesus*.]—*Archiv. f. Protistenkunde*. 1914. Mar. 28. Vol. 34. No. 1. pp. 35-38. With 8 text-figs.

Only encysted forms were seen with certainty, but a few other forms were observed regarding which there was some doubt as to whether they were free or encysted.

The cysts varied from 8 to 25 microns in diameter, and they were either round or oval in shape. In some cases the cyst-wall was very thin and in others sufficiently thick as to appear distinctly double-contoured.

The best stained preparations were given by Haidenhain's iron haematoxylin, Böhmer's haematoxylin, and moist Giemsa staining.

The protoplasm presents either a vacuolar or granular appearance, the vacuoles being in some cases very large.

The nucleus contains a caryosome. Specimens containing, 1, 2, 4 and even 8 nuclei were seen.

Chromidial masses are present in the cytoplasm, and these are usually rod-like.

In those parasites which were possibly not encysted the nuclei were indistinct, and the chromidia were either small or absent.

It is impossible to identify the parasite with certainty, but the occurrence of forms containing 8 nuclei suggests that it may be *Entamoeba coli*.

(175) Laveran (A.) & Franchini (G.). **Infezione Sperimentale dei Mammiferi Mediante Flagellati del Tubo Digerente del** *Ctenocephalus canis* [The Experimental Infection of Mammals with the Flagellates from the Alimentary Canal of *Ctenocephalus canis*.]—*Pathologica*. 1914. Jan. 1. Vol. 6. No. 124. p. 1.

Five white mice inoculated intraperitoneally with the contents of infected dog fleas became infected, and nine mice inoculated, some intravenously and some intraperitoneally, with the spleen or liver pulp of a mouse in which the parasites were found also became infected.

The authors were able to transmit the infection through three passages in mice. Seven mice died. The objection that the bacteria introduced with the flagellates contributed to the death of the mice is met by the fact that the infection was transmitted by blood from mouse to mouse and the blood used proved sterile by cultivation.

The disease lasts from 24 to 123 days. There is enlargement of the spleen, but in those inoculated directly from the fleas the numerous bacteria present no doubt contributed to this. Parasites may be found in the liver, blood, spleen, and bone marrow.

They resemble leishmania, and flagellate forms are very scanty. Intracellular parasites were sometimes found.

The authors have also succeeded in infecting a white rat and a dog. The rat was inoculated from an infected mouse, and parasites appeared in the blood two months later. The dog was inoculated intraperitoneally twice, with spleen and liver pulp from infected mice, and once intravenously with blood from a heavily infected mouse. The dog died 50 days after the first inoculation as the result of a complication.

Parasites were scantily present in the liver, spleen, lymphatic glands, and bone marrow. In one smear made from the axillary gland a single flagellate form was found.

(176) Sangiorgi (G.). *Leucocytogregarina cuniculi* **n. sp.**—*Patho-logica.* **1914. Jan. 15. Vol. 6. No. 125. pp. 49-50. With 1 text-fig.**

The author has discovered this parasite in a domesticated rabbit. The majority of the parasites occurred in a gregarine-like form. They possessed an elongated, slightly curved body with rounded ends. When stained with Giemsa the body appeared blue and finely granular, and contained towards the wider end some little specks of chromatin. The nucleus is oval and is generally placed near the narrower pole of the parasite. The chromatin is in the form of small particles embedded in an unstained matrix. The parasite is surrounded by a definite zone corresponding to a capsule.

The parasites measure 16 to 18 microns in length, by 4 to 5 in width. They are extracellular and are found scattered among the cells in preparations made from the spleen.

More rounded forms with compact-looking nuclei have been observed. Similar forms of smaller size have been observed included within mononuclear leucocytes. No multiplication forms have been seen in preparations made from any of the organs.

RABIES.

(177) Konrádi (D.). **Die Vererbung der Wut. iii. Mitteilung.** [The Transmission of Rabies.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1914. Mar. 30. Vol. 73. No. 4/5. pp. 287-296.

Conclusions :

1. The virus of rabies passes from the mother to the foetus, but becomes attenuated by so doing. In consequence of this rabies develops progressively later in inoculated animals.

2. There appears to be no difference in this transmission in the various species of animals. It occurs in the dog, guinea-pig and rabbit, and probably in other species also.

3. In such investigations the test inoculations must be made subdurally, and guinea-pigs but not rabbits must be used. Guinea-pigs are far more susceptible to rabies, and therefore the experiments fructify more rapidly and with greater certainty than if rabbits were used. If rabbits are employed rabies either develops very late or not at all. This point was left out of consideration by previous authors who were therefore led to false conclusions.

4. The period of observation in the case of foetuses of infected animals must be longer in those cases in which guinea-pigs are used, as the disease develops after a longer interval than when the animals are infected after birth.

5. The virus of rabies is circulating in the blood of the mother at the time when the first symptoms of the disease appear, and even earlier, and it passes the placenta weeks and even months before the death of the mother.

6. The bite of a dog is dangerous 14 days before the onset of rabies.

(178) MANOUÉLIAN (Y.). **Recherches Histologiques sur les Glandes Salivaires dans la Rage.** [Histological Examinations of the Salivary Glands in Rabies.]—*Ann. Inst. Pasteur.* 1914. Mar. Vol. 28. No. 3. pp. 233-237. With 2 plates.

This paper contains an account of the author's investigations of the nerve ganglia in the salivary glands of about a score of dogs affected with street rabies.

Negri bodies cannot be detected in any portion of the gland tissue itself, but they are constantly present, and in large numbers, in the cytoplasm of the nerve cells of the ganglia embedded in the interstitial tissue of the glands.

The author draws attention to the possibility of mistaking débris of gland cells and other bodies for Negri bodies. For example, polynuclear leucocytes which invade the gland tissue in considerable numbers rapidly undergo degeneration. The nucleus fragments and these fragments become acidophile, staining red with Mann's stain. Glandular cells which have undergone hyaline degeneration sometimes contain bodies which may be mistaken for Negri bodies.

The lesions described by NELIS and van GEHUCHTEN as occurring in cerebro-spinal sympathetic ganglia may also be found in the ganglia in the salivary glands.

As shewing how special Negri bodies are to the nerve cells, the author states that at places on the nerve trunks which accompany the vessels in the gland, small groups of nerve cells and even single nerve cells may be found, Negri bodies being found in these cells only, and never in the gland tissue or its secretions.

The following changes are observed in the acini. The acini become invaded by polynuclears, these disintegrate and the whole of contents of the acini are taken in by macrophages. In this way acini are completely changed into masses of macrophages. The cells of the acini appear to undergo a process of degeneration due to the liberation of some substance or substances through the disintegration of the polynuclears.

At places the periacinous connective tissue is also destroyed, and in this way large groups of macrophages are formed. In the ducts similar changes are observed. Large numbers of polynuclears pass into the lumen and disintegrate, and numbers of the cells lining the ducts also undergo disintegration.

These elements are found in the saliva of rabid dogs.

(179) CRUICKSHANK (J. A.) & WRIGHT (R. E.). **A Note on Some Experiments performed with a View to finding out the Period before Symptoms during which the Saliva of an Animal incubating Rabies is infective.**—*Indian Jl. Med. Research.* 1914. Jan. Vol. 1. No. 3. pp. 532-535.

The animals used in these experiments were inoculated subdurally with street virus. The saliva was obtained either from the mouth or by fistula from the parotid and submaxillary glands. Thick suspensions were made of the glands after death which were used for subdural and intramuscular inoculation in doses of 1 to 2 cc. The

saliva was injected intramuscularly owing to the likelihood of its setting up meningitis if injected subdurally. Negri bodies were looked for in all cases in the hippocampus and cerebellum, and in doubtful cases passage experiments were resorted to.

The details of the experiments performed are given in tabular form.

Conclusions :—

"1. It is difficult to infect rabbits and guinea-pigs either intramuscularly or subdurally with the saliva of dogs or guinea-pigs in the presymptomatic stage of rabies. The table shows that in one case the saliva of a dog was infective three days before the animal showed symptoms.

"2. Even when the symptoms of rabies have manifested themselves it is still difficult to demonstrate the infectivity of saliva experimentally. This suggests that the bites of rabid dogs, even under optimum conditions for infection, may not infect because the saliva is not virulent.

"3. Suspensions of the salivary glands themselves are much more certainly infective under experimental conditions than the saliva derived from them. This is more especially the case for the submaxillary gland.

"4. Negri bodies are not always demonstrable in the brains of experimental rabid animals, although they may become so after sub-passage."

(180) Pokschischewsky (N.). **Ueber Methoden der Schutzimpfung gegen Tollwut.** [Methods of Immunisation against Rabies.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1914. Jan. Vol. 76. No. 3. pp. 453-468.

The author's experiments were undertaken to ascertain whether it is possible to confer active immunity upon animals, and in particular upon dogs, by means of Pasteur's original method, and whether the intraperitoneal inoculation of the fresh brain substance of passage rabbits is capable of setting up active immunity.

The following conclusions are drawn :

1. Pasteur's original method is incapable of protecting dogs and rabbits against subdural and intramuscular inoculation with street virus.

2. A sure method of infecting must be used when the immunity of animals that have been treated is being tested. Such methods are : subdural and intramuscular inoculation. Intra-ocular inoculation is less certain. Very uncertain results are given by subcutaneous inoculation, or by the bites of infected dogs.

3. In testing immunity, in addition to the method of infection, attention must be paid to the type of virus used in the test, whether it is street or fixed virus.

4. Our experiments show that the intraperitoneal inoculation of rabbits and dogs with large doses of fresh fixed virus confers a sure active immunity against intramuscular inoculation with street virus.

5. The original fixed virus inoculated intraperitoneally confers an active immunity upon dogs and rabbits in about 50 per cent. of cases against subdural inoculation, which is the most severe method of infection.

6. The intraperitoneal method of protective inoculation appears to be a promising one for application in practice, for example, for the protection of valuable dogs against the bites of rabid dogs in infected areas. It also forms a firm basis for further investigations regarding the protective inoculation of larger animals, such as the horse and ox.

RINDERPEST.

(181) MONTGOMERY (R. E.). **Report on Double Inoculation against Rinderpest at Lumbwa (East Africa Protectorate, February 1914.)**—MS. Report dated March 30th, 1914. Received through the Colonial Office.

Five thousand seven hundred and forty-five animals were inoculated by Montgomery and the veterinary staff within a period of three days. The total mortality was 37, this figure including all animals dying within three weeks of the inoculations. Many of the deaths were due to causes other than rinderpest. Some animals, probably seven, died from redwater transmitted by the virulent blood used for the inoculations.

A tabulated statement gives the classification of all the stock in the Lumbwa District and each owner gave the number of animals which he knew to be susceptible to rinderpest. These figures cannot be taken as absolutely accurate as one death occurred among draught oxen recorded as being immune.

Bulls. 34 of which 13 were susceptible. Two were imported pure-bred animals. No deaths.

Cows. (*a*) In calf. 769, of which 432 were susceptible. Reactions all normal. No deaths.

(*b*) Heifers in calf. 498, of which 305 were susceptible. Reactions normal and no deaths.

(*c*) Cows not in calf. 693, of which 243 were susceptible. Reactions normal. No deaths.

Four abortions occurred on one farm among 445 in-calf animals. A report regarding the occurrence of abortion following inoculation is to be delayed for a period of three months after the inoculation.

The percentage loss of milk during the week when the reactions were at their height was 9·09 and the following week the yield was normal again.

Work oxen. 1,381, of which 433 were susceptible. One death occurred in a batch of animals believed to be immune.

Young stock. 1,177, of which 1,148 were susceptible. The reactions in these animals were rather more severe and 20 deaths or 1·74 per cent. were recorded.

Calves. 820 were inoculated. All save 11 of these were susceptible. Distinct temperature reactions followed, but the clinical symptoms were mild. There were 16 deaths, of which several were due solely to redwater.

The total death rate was 0·6 per cent., and the death rate among the susceptible animals was 1·09 per cent.

The virulent blood which served as the primary source of infective blood for the inoculations was obtained from a Uganda control at the laboratory.

(182) HARTLEY (P.). **On the Immune Bodies occurring in Anti-Rinderpest Serum, and on the Variations occuring in the Serum Proteins during Rinderpest and during Immunisation and Hyperimmunisation.**—*Mems. Dept. Agric. in India, Vet. Ser.* 1914. Jan. Vol. 1. No. 4. pp. 178-270.

The experiments detailed in this paper were carried out with the

object of discovering some method whereby anti-rinderpest serum could be economically prepared in a stable form.

A certain degree of success has been obtained, in that it has been found possible to prepare in a powdered form those serum proteins which are combined or associated with the immunising substance. The author points out that the study of immune bodies in rinderpest offers greater difficulties than the study of immune bodies in such sera as anti-diphtheritic and anti-tetanic sera, for the reasons that the anti-serum can only be tested against the disease and not against toxin produced outside the body, and also that guinea-pigs and small animals are not available.

It was found that rinderpest immune bodies are precipitated when anti-rinderpest serum is dialysed. The precipitation is complete when tap water is used, but prolonged dialysis (6 days) against distilled water failed to complete the precipitation.

In some cases the rinderpest prophylactic could be prepared in the form of a dry powder which when injected after emulsification conferred protection upon susceptible animals.

Dilute acids exert a deleterious effect upon the immune bodies, but alkalis (0·4 per cent.) do not.

The immune bodies are associated with the euglobulins. They are precipitated by dialysis or saturation with common salt.

They are precipitated on half saturation with ammonium sulphate and are not extracted from the precipitate by saturation with common salt.

The second portion of the paper contains experiments designed to ascertain the quantitative changes occurring in the serum proteins of animals during an attack of rinderpest. The methods used were those described by Gibson and Banzhaf in 1910.

It was found that the protein-content of the serum of animals of the same species varies considerable. The composition of serum protein of healthy animals may remain constant for periods varying from 11 to 21 days, and is not affected by repeated small bleedings at short intervals.

Examination of serum obtained from animals at intervals during attacks of rinderpest terminating fatally shewed that certain changes occur. The total heat-coagulable protein diminishes. The variations in the absolute amount of albumin per unit volume of serum are the least pronounced. A decrease was observed in the amount of the globulin and of the proteins insoluble in saturated sodium chloride. Comparison of the amounts of albumin, globulin, and proteins insoluble in common salt before inoculation, and just before death, shows that the amount of albumin has increased, and that the globulin and proteins insoluble in salt have diminished.

The third portion of the paper is on the same lines as Part II, but it deals with sera taken during immunisation and hyper-immunisation.

In 11 out of 13 animals the following changes were observed :—

1. The total protein per unit volume increased in all cases.

2. In 10 cases a decrease in the absolute amount of albumin per unit volume was observed.

3. The absolute amount of globulin per unit volume increased in all cases.

4. The most pronounced changes were observed in the proteins insoluble in saturated salt solution. An increase was observed in all cases.

In the other two animals decreases in the globulin group and in the group insoluble in salt solution were recorded. This was probably due to the fact that during immunisation the animals passed through severe attacks of the disease. Repeated large bleedings at short intervals caused a decrease in the total protein, but the various proteins are affected differently. There is little variation in the absolute amount of albumin. Globulin decreases in all cases and a more marked diminution occurs in the proteins insoluble in salt.

In Part II it is shewn that the immune bodies are associated with the latter group, and it is suggested that the large increase in this group which is associated with successful hyper-immunisation indicates an accumulation of immune bodies.

(183) Mrowka (F.). **Studien ueber die Ostasische Rinderpest.** [Eastern Asiatic Rinderpest.]—*Zeitschr. f. Infektionskranhk. parasit. Krankh. u. Hyg. d. Haust.* 1914. Mar. Vol. 15. No. 2. pp. 139-156. With 3 plates.

Rinderpest entirely disappears in Eastern Asia during the hot weather, and reappears with the onset of the cold weather. Sometimes intervals of several years elapse between outbreaks. The disease runs a mild course owing to the high degree of natural resistance offered. Doubts have been expressed as to whether the disease is actually rinderpest or not, but that question has been settled by experiments with animals possessing the ordinary degree of susceptibility.

The slaughterhouse at Tsingtau has furnished ample material for clinical and pathological examinations, but owing to the difficulty associated with the experimental infection of Asiatic animals, and the cost of importing susceptible animals, extensive transmission experiments have not been possible. Clinically the disease presents features which differ greatly from those seen in Germany ; they suggest merely a temporary indisposition. The diagnosis is however established by the elevation of temperature, the lesions, and the sterility of the blood as regards visible bacteria, and by its virulence.

If the animals are not slaughtered, recovery almost always follows.

If an animal be killed when the febrile stage has lasted for some days, the typical lesions are found, and partially or completely healed lesions may also be seen. The author has always found fresh and healed ulcers in cases of rinderpest, and though the latter cannot have been produced during the short febrile attack, he concludes that they must be looked upon as typical. Erosion ulcers in the mouth are also pathognomic.

Lesions of the same type were found in apparently healthy animals when slaughtered. They were found in animals born during periods when the disease did not make its reappearance, and in animals which could not have passed through an attack of the disease. They were not found so frequently when a period of about three years had elapsed without an outbreak of the disease. The authors think that

this is without doubt proof of the causal relationship between the disease and the lesions.

Histological examination of the stomach lesions has been made, but the material used was obtained from apparently healthy animals, as no case of rinderpest occurred at the time when the work was being done.

The author concludes from his examinations that the erosions are primarily due to haemorrhages into the mucous coat. The haemorrhages cause local disturbances of circulation and nutrition, and autodigestion occurs. The occurrence of a succession of haemorrhages is responsible for the production of lesions which shew evidence of having been in existence for different lengths of time, and also for their occurrence in animals that are apparently healthy. The submucous coat is never involved, and the ulcerations never cause perforation.

Details are given of an imported animal which was experimentally infected with blood from a native animal. The disease ran the usual course, and the symptoms and lesions were typical.

The occurrence of similar lesions in the stomachs of new-born calves indicates that the infection may be contracted in utero, and this offers an explanation of the insusceptibility of Asiatic cattle to the disease.

Animals that have contracted the disease and recovered may remain sources of infection for long periods, and may form the starting point of fresh outbreaks. Consequently quarantine is not an effective method of controlling the disease.

In this fact also lies an objection to the simultaneous inoculation method of protecting animals.

TSETSE FLIES.

(184) Woosnam (R. B.). **Report on a Search for Glossina on the Amala (Engabei) River, Southern Masai Reserve, East African Protectorate.**—*Bull. Entom. Research.* 1914. Feb. Vol. 4. No. 4. pp. 271-278. With 1 map.

Abstract of conclusions :—

The tsetse fly area on the Amala River presents several points of interest. The species of fly is the Western *Glossina fusca* which has not previously been recorded in the East African Protectorate. The fly appears to be confined to the west bank of the river, or only occasionally strays to the east bank. Natives have been living for years in the district, and their cattle graze to within 400–500 yards of bush where flies exist all the year round, but they have lost only a few animals. Several sportsmen have lost mules and trek oxen.

Two explanations are offered regarding the small losses sustained by natives :

a. The natives may be so familiar with the distribution of the fly, which appears to be confined to definite areas, that they avoid exposing their cattle.

b. A very small percentage of flies may be infected, either because the reservoir is limited, or some climatic influence (such as altitude—5,200 feet) may affect the receptivity (Roubaud) of the fly.

HELMINTHS.

(185) Railliet (A.), Henry (A.), & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. I. Trématodes et Cestodes.** [The Helminths of the Asiatic Elephant. I. Trematodes and Cestodes.]—*Bull. Soc. Path. Exot.* 1914. Jan. Vol. 7. No. 1. pp. 78-83. With 2 text-figs.

1. Trematodes. Four species belonging to this group have been described :—(1) *Fasciola jacksoni* Cobbold 1869—bile ducts and duodenum. (2) *Pseudodiscus hawkesi* Cobbold 1875—large intestine. (3) *Watsonius ornatus* Cobbold 1882—intestine. (4) *Pfenderius papillatus* Cobbold 1882—large intestine.

2. Cestodes. (1) *Echinococcus veterinorum* Rud. 1810. This parasite has been recorded in one instance only—by Bonvincini in 1897. (2) *Anoplocephala manubriata* n. sp. Two specimens of this parasite were found by the authors in 1910. The parasites were apparently incomplete as detached segments and groups of segments were also found. The specimens measured 1·5 and 2·6 centimetres in length, and 1·2 and 1·6 centimetres in width. Some of the free segments found were, however, 4 centimetres wide.

The scolex is large and square measuring 5 to 7 millimetres from side to side. It is somewhat compressed from before behind. There are neither hooks nor rostrum, the four suckers being separated from each other by depressions. The suckers shew concentric markings. The vertical groove is more pronounced, and it is prolonged along the upper and lower surfaces of the worm for a distance of about 3 millimetres and terminates in a shallow longitudinal fossa.

The segments are very short, and, as is often the case with the Anoplocephala, they are united by the central part only, the free edges forming leaf-like projections which to a great extent cover the succeeding segments.

The genital organs are completely developed at a distance of 2 centimetres from the scolex, but the uterus does not contain any eggs at that point. The testicles are small and very numerous. They are disposed in the dorsal portion of the segment and extend across practically the whole width of the parasite. There are two sperm ducts which unite and the single duct terminates in a convoluted vesicle.

The genital pore is situated towards the anterior third of the left side of each segment and takes the form of a little capsule which is directed forwards. The vagina has a fairly large receptaculum about 3 millimetres from the pore. The uterus is transversely placed and has numerous side branches.

Eggs were not found in the segments attached to the parasite, but in the free segments the uterus appeared as a single transverse row of pouches packed with eggs. The eggs had an irregularly circular or slightly polygonal outline, and measured from 70 to 80 microns in diameter. They contained a pyriform structure enclosing an embryo measuring from 17 to 22 microns.

While the worm resembles the Anoplocephala in its general characters, it differs from them in the disposition of the genital glands, but the authors propose to place it in that genus provisionally.

(186) Railliet (A.), Henry (A.) & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. II. Nématodes. A.** [The Helminths of the Asiatic Elephant. II. Nematodes.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 129-132. With 1 text-fig.

Ascaridae.—

1. *Ascaris lonchoptera* Diesing, 1851 (*Strongylus elephanti* Rud., 1819),—bile ducts and duodenum.

Strongylidae.—

The parasites found in the elephant and belonging to this family are represented by the *Bunostomeae, Strongyleae, Cylicostomeae.*

Bunostomeae.—

1. *Bathmostomum sangeri* (Cobbold, 1882),—intestine.
2. *Grammocephalus clathratus* (Baird, 1868),—bile ducts and intestine. This parasite also occurs in the African elephant.
3. *Bunostomum foliatum* (Cobbold, 1882),—gastric tumours and intestine.

This parasite is classified in this genus provisionally.

Strongyleae.—

1. *Evansia renniei* (Railliet and Henry, 1913),—stomach and possibly the bile ducts.
2. *Strongylus additictus* n. sp.

General characters. The body is cylindroid and somewhat attenuated at either end. The anterior end is truncated in a slightly oblique direction. The colour is greyish, but on either side there are reddish brown longitudinal stripes. The cuticle is transversely striated. The mouth is surrounded by a ring of very small plates. The buccal cavity is subglobular measuring 500 microns in length and 450 in width at the widest part. The wall is relatively thick and the anterior edge is surrounded by a distinct collar. This is incised on either side and above and below for the passage of six cephalic papillae. At the bottom of the buccal cavity there are two subventral teeth. 160 microns in length.

The oesophagus is club-shaped and rather less than 2 mm. in length. It is cylindrical for about half its length, and measures 225 microns in diameter. Its posterior extremity shews three bilobed valves.

Male.—The male is 20 mm. in length and about 1·5 in width. The caudal pouch resembles that of the other Strongyleae, but owing to the disposition of the posterior rays it resembles that of Ankylostoma rather than that of Strongylus. The rays are formed of a very long common trunk with poorly developed free portions.

The spicules are rather more than 2 millimetres in length, stout at their base, and taper off in a very marked manner.

Female.—Measures from 18 to 24 millimetres in length and 1·4 to 1·6 in width in front of the vulva, and 1·3 to 1·4 behind it. There is a sudden constriction at the vulva which is situated $\frac{8}{5}$ of the length from the anterior extremity. The vagina is directed forwards, but is soon lost in a convoluted mass of genital tubes. The ovijectors have not been observed. The eggs are ellipsoid, thin-shelled, and at the time of deposition segmentation of the contents is at a very early stage. The eggs measure 65–74 by 42–45 microns. The caudal extremity is in the form of a very obtuse cone and the anus opens 300 microns in front of it.

At two places in this paper the name of this parasite is given as *S. additicius.*

(187) Railliet (A.), Henry (A.), & Bauche (J.). **Sur les Helminthes de l'Eléphant d'Asie. III. Nématodes. B.** [The Helminths of the Asiatic Elephant. III. Nematodes. B.].—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 206-210.

Stongylidae.—

Cylicostomeae. This sub-family is represented by a number of forms which present such marked differences that no doubt special genera will have to be made for them.

For the present, the authors include all, with the exception of one, in the genus *Cylicostomum* Looss (sensu lato).

1. *Choniangium* nov. gen. Cylicostomeae with the anterior extremity obliquely truncated so that the mouth is directed forwards and upwards. Buccal capsule larger in front than behind where the wall is thickened. There is a dorsal tunnel; no internal teeth, but irregular bosselations. Mouth surrounded by a ring of long narrow laminae. Posterior rays of the caudal pouch quadridigitate, the posterior ray being united to that of the opposite side to form a common trunk; the two intermediate rays united, and the external one separate and longer. Spicules long, slender, tubular, and tapering to the extremities which are curved. One accessory piece. Vulva close to the anus. Eggs segmented at the time of oviposition.

Type species: *Sclerostomum epistomum* Piana and Stazzi, 1900.

(1) *Choniangium epistomum* (Piana and Stazzi, 1900),—colon.

(2) *Cylistomum sipunculiforme* (Baird, 1859),—intestine.

(3) *Cylicostomum falciferum* (Cobbold, 1882),—intestine and stomach. This species has also been found in the African elephant.

(4) *Cylicostomum pileatum* n. sp.

General characters. Body cylindroid tapering to both extremities. Cuticle shews coarse transverse striations. At the posterior part of the body the cuticle shews some swellings having wide striations, which must be viewed as a system of secondary markings, and between which a very delicate striation can be seen. The mouth is slightly elliptical in the dorso-ventral direction. The terminal portions of the laminae (36) surrounding it form teeth about 10 microns long.

The buccal cavity is 40 microns deep. The anterior edge has an inner ring of denticulations, equal in number to those in the outer ring. At the bottom there is a third ring of very delicate denticulations. The oesophagus is formed of two subspherical swellings, the posterior of which is slightly the larger. The inner surface is very chitinous and the lumen dilates anteriorly in a funnel-like manner, effecting a wide communication with the buccal capsule. The outer surface of the whole of the anterior dilatation and a small part of the outer wall of the posterior dilatation is covered with a striated capsule 16 microns in thickness.

The wall of the intestine, particularly in the anterior part, is deeply pigmented black.

Male. The authors have had the opportunity of examining a single specimen only. This measured 9·5 mm. in length by 400 microns in width. It was characterised particularly by a long tongue-like appendage representing the posterior lobe of the caudal pouch. Just in front of the bursa there was a vesicular swelling of the cuticle. The spicules were about 2·7 mm. in length, but accurate measurement was impossible owing to the lack of material.

Female. Measures from 11·5 to 14 mm. in length, by 550 to 630 microns in thickness. The caudal extremity is conical and has the cuticular swellings already mentioned. The anus and vulva open 450–500 microns and 700–725 microns respectively from the posterior extremity. The vulva is a transverse aperture 60 microns in length. The vagina is very long and directed forwards. It divides into two parallel ovijectors in the posterior fourth of the body. The eggs are ellipsoid and are provided with thin shells. They measure 67 to 73 microns by 42 to 45 microns, and are deposited in the hollow morula stage.

Spiruridae—

Only one species appears to belong to this family.

Spiroptera smithi (Cobbold, 1882,)—tumours in the stomach with orifices communicating with the interior of the organ.

The authors think that this parasite should be placed in a genus between the Spirura and Acuaria.

Filariidae—

Only one parasite belonging to this family has been described, namely a microfilaria found by Evans and Rennie in the peripheral circulation.

(188) i. Yakimoff (W. L.) & Schokhor (N. I.). **Recherches sur les Maladies tropicales humaines et animales au Turkestan. (4.) Les Microfilaires des Animaux domestiques au Turkestan.** [Investigations regarding Human and Animal Tropical Diseases in Turkestan. (4.) The Microfilariae of the Domesticated Animals in Turkestan.—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 188-189.

(189) ii. Yakimoff (W. L.), Schokhor (N. I.), Koselkine (P. M.), Winogradoff (W. W.) & Demidoff (A. P.). **Recherches sur les Maladies tropicales humaines et animales au Turkestan. (5.) La Microfilariose des Chevaux au Turkestan.** [(5.) Equine Microfilariasis in Turkestan.]—*Ibid.* pp. 189-192.

i. The authors have examined camels, donkeys, mules, cattle, dogs, sheep, and goats for microfilariae, and have found them in the first four species. In four different districts the percentage of camels infected varied from 4 to 22·5. The percentage in the case of donkeys varied from 2 to 3·8. Infected mules were found in one district only, where 2 per cent. were found. Infected cattle were found in two districts, the percentage of infected animals being 5·6 and 15·2. The number of animals examined at each place is not given.

ii. Microfilariae were found in the blood of 41 horses out of 109, which arrived at Taschkent from Termese.

An extensive examination of horses in a number of districts shewed that the disease has a wide distribution. The leucocyte formula of infected horses is as follows:

Lymphocytes	28·6 to 48·8 per cent.
Large mononuclears	0 „ 1·4 „
Transitional forms	1·7 „ 4·3 „
Neutrophile polynuclears	40 „ 56·1 „
Eosinophiles	5·1 „ 11·7 „
"Türk" forms	0·5 „
Myelocytes	0·8 „

The percentage of infected horses varied from 0·53 to 37·5, but in all cases except the maximum given the number was below 9 per cent.

The parasite is provided with a sheath and there are three (sometimes two) white areas in the cellular column.

The first is at the anterior extremity, is oval in shape and measures from 5·68 to 10·65 microns in length. The second, which is transversely placed and measures 1·42–7·1 microns, is situated at a point 38 to 50 microns from the anterior area.

The third, which is sometimes absent, is irregularly oval and occupies the whole width of the parasite. It is placed from 142–172 microns from the anterior extremity.

The length of the parasite including the sheath varies from 270·45 to 323·76 microns, and excluding the sheath from 158·98 to 266·96 microns. The width including the sheath is from 7·1 to 11·36 microns, and excluding it from 4·24 to 9·94 microns.

At the posterior extremity there is a free portion of the sheath measuring from 4·2 to 78·1 microns.

At the anterior extremity the sheath is also always free, and in one instance in which a measurement was made the free portion measured 21·3 microns.

Three examinations as to periodicity have been made, but none has been observed.

A donkey and a sheep were found to be insusceptible.

The intravenous injection of 4·5 gm. of salvarsan caused a slight diminution in the number of parasites. The parasite is said to correspond most closely with that described by MANDEL, but a detailed description of that parasite is wanting. The chyluria mentioned by MANDEL has never been observed in Turkestan.

In the event of the parasite proving to be a new species the name *Microfilaria Ninae Kohl-Yakimovi* is suggested.

(190) WIRTH (D.). **Filariosen bei einheimischen Pferden.** [Filariae in Native Horses.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1914. Mar. Vol. 15. No. 2. pp. 135-138.

After referring to the fact that he has already published descriptions of four cases of equine filariasis, the author proceeds to give details of a fifth case.

The case was brought to the clinique at the Veterinary High School at Vienna, in August 1912, with a history that the animal had been dull for three months and had steadily lost its appetite. The temperature was sub-normal and one micro-filaria was found in the blood.

Two months later the animal was under observation again, but in spite of repeated observations microfilariae were not found. The haemoglobin content of the blood was 75° on Sahli's scale; the red corpuscles numbered 9,792,000 and the white 13,760 per cmm. Differential count of the white corpuscles gave the following percentages: polynuclear neutrophiles 57, eosinophiles 8, lymphocytes 31, and mononuclears 4.

On the author's suggestion BAHNMULLER carried out systematic examinations of horses for microfilariae and found 24 infected out of 280, the horses coming from different parts of Hungary. The following year 5 out of 75 animals were found to be infected.

It is probable that the severity of the symptoms depends upon the number of parasites present in the blood. To what extent mechanical and toxic effects are responsible for the symptoms is not determined.

The identity of the parasite has not been established.

(191) Delanoë (P.). **Au Sujet de l'Existence chez un Saurien, *Agama colonorum* Dum. et Bibr., d'une Filaire et d'une Microfilaire Sanguines.** [The Occurrence of a Filaria and a Microfilaria in the Blood of a Lizard, *Agama colonorum* Dum. and Bibr.]—*Bull. Soc. Path. Exot.* 1914. Feb. Vol. 7. No. 2. pp. 121-125. With text-figs.

Sheathed microfilariae were found in the blood of one lizard out of seven examined. There appeared to be no periodicity.

In moist preparations the sheath is difficult to make out except at the extremities, but the worm can be seen executing wriggling movements within it. Empty sheaths and worms devoid of sheaths were seen.

In stained preparations the worm shewed a transverse striation. Specimens measured about 190 microns in length and 6 in width.

In blood containing adult filariae the author has discovered motionless vermicule-like structures enclosed in very distinct sheaths. At one extremity a small granule with the staining reactions of chromatin could be detected. The author thinks that these bodies are atrophied eggs which have been passed out into the circulation at the same time as the completely developed microfilariae.

A group of 8 adult female filariae was found entangled with each other in the substance of the liver, but there was no degeneration of the liver tissue.

The parasites measured 12–13 centimetres in length by 0·275 millimetres in thickness, they were milky-white in colour, and in moist preparations the uterus could be seen packed with microfilariae in different stages of development.

The mouth is terminal, unarmed, and devoid of papillae. The vagina opens about 0·5 mm. behind the mouth. The cuticle is smooth, and both extremities are obtusely pointed.

OESTRIDAE.

(192) Gedoelst (L.). **Note sur un Nouveau Genre d'Oestride.** [Note on a New Genus of Oestruus.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 210-212.

The author refers to the description given by Blanchard in 1893 of a larva obtained from *Boselaphus* (*Bubalis*) *lichtensteini*, to which Blanchard gave the name Kirk's larva. Reference is also made to a larva in the collection at the Natural History Museum, Paris, which was found by Decorse in the sinus of a buffalo in the Chari District in 1903. These appeared to be practically identical with each other. The author has received some larvae from the frontal sinus of a *Bubalis major* forwarded by Dramard. These differ only in secondary characters from Decorse's specimens.

In the present note the author gives the characters which shew that the larvae are a special type of the sub-family Oestrinae.

The body resembles that of Oestruus. The antennary segments are provided with three ocilliform points, parabuccal rings unarmed, spicules exclusively ventral, and placed along the anterior edges of the third to twelfth rings, and arranged in linear groups of four to six spines on either side of the posterior margins of the fifth to eleventh segments. Posterior stigmata of the type of those of Oestruus. The suture which unites the false-stigma at the inner edge of the stigmatic plate joining this obliquely at its lower fourth.

The author suggests the formation of a new genus for these parasites and distinguishes at least two species, *Kirkia blanchardi* for that originally described by BLANCHARD, and *Kirkia surcoufi* for those collected by DECORSE and DRAMARD.

(193) ROUBAUD (E.). **Oestrides Gastricoles et Cavicoles de l'Afrique Occidental Française.** [The Gastric Oestridae and the Oestridae of the Sinuses of French West Africa.]—*Bull. Soc. Path. Exot.* 1914. Mar. Vol. 7. No. 3. pp. 212-215.

The oestrides have been found as parasites in the frontal sinus of *Bubalis major* (Blyth) in West Africa.

(1) *Oestruus variolosus* (LOEW). Two adults of this species, described by LOEW in 1863, have been obtained by DRAMARD from larvae derived from *Bubalis major* at Boromo.

The larvae differ from those figured but not described by KING, which were found in a buffalo on the Blue Nile, by the slightly larger areas of spines, and by the absence of intermediate ventral segments, but these differences may be due to the method of preparation or to the manner of figuring.

The larvae differ from those of *Oestruus macdonaldi* Gedoelst from *Bubalis lelwel jacksoni* in the possession of smaller creeping areas which are more regularly attenuated at the sides, and also by the absence of incurvation of the 12th segment. These differences are very marked and distinguish the oestruus of the Katanga buffalo from that of the Sudan buffalo. These two larvae belong to the same group (Oestroides of GEDOELST) and are characterised by the cephalic segment being provided with small spines posterior to the antennal swellings and by the absence of tubercles on the ventral surface of the segments.

When fully extended *Oestruus variolosus* measures from 18 to 23 millimetres. The ventral surface is flat and the dorsal convex with 8 intermediate areas The cephalic segment is provided with a number of short spines arranged in rows on the dorsal surface posterior to the antennal prominences. The other segments are unarmed on the dorsal surface. There are no tubercles on the lateral surfaces. The spines increase in number on the first five segments and decrease on the last two. Two rows of irregular spines on the sides of the first post-cephalic segment : a single one on the median line ; two or three rows on the second ; four or five on the largest posterior sections.

The areas of creeping spines form bands which taper laterally and occupy the greater part of each segment in the middle portion of the body. The spines are in the form of scales with wide colourless bases

and sharp black tips. There are two or three rows on the median post-anal prominence.

(2) *Gedoelstia cristata.* Several adults have been raised by DRAMARD from larvae obtained from Lichtenstein's buffalo. Apparently the parasite has a wide distribution, and it is not specific for the buffalo.

(3) *Kirkia surcoufi.* This parasite has also been found in *Bubalis major* and an antelope (*Cobus defassa*, probably) by DRAMARD and BOUET. Although it has a wide distribution, it is probably not found outside Central and Western Soudan. In Eastern Soudan *Kirkia blanchardi* is no doubt the species which occurs.

CONTAGIOUS PLEUR-OPNEUMONIA and PASTEURELLOSIS.

(194) WALKER (G. K.). **Pleuro-pneumonia of Goats in the Kangra District, Punjab, India.**—*Jl. Comp. Path. & Therap.* 1914. Mar. Vol. 27. No. 1. pp. 68-71.

After reviewing briefly the literature regarding the occurrence of pleuro-pneumonia in goats, the author gives a short description of seven natural cases of the disease and of seven experimental infections. The first goat of the series of natural cases recovered from the disease and subsequently resisted experimental infection with a virulent strain of haemorrhagic septicaemia, and also failed to become infected when nasal discharge from an affected animal was rubbed on its nostrils and mouth. In the remaining six cases cultivation and microscopic examination failed to reveal organisms of any kind.

The seven experimental goats, all of the plains breed, were inoculated with exudate or blood from natural cases, but in every instance the result was negative.

Conclusions.—The pleuro-pneumonia of goats met with in Kangra appears to be identical with the enzootic pleuro-pneumonia of goats described by NOCARD and LECLAINCHE as occurring in Algeria, the Pyrenees, and the Thuringian mountains. The symptoms and lesions are similar, and the failure to transmit the disease from animal to animal is coincident.

The value of the above experiments is depreciated no doubt from the fact that plains animals had to be used. If possible, further investigations with hill goats will be made, with the object of proving the possibility of transmission by means of intrapulmonary inoculation.

(195) MITRA (S. N.). **On a Peculiar Form of Pasteurella in an Indian Elephant.**—*Centralbl. f. Bakt.* 1. Abt., Orig. 1914. Feb. 11. Vol. 73. No. 1. pp. 12-13. **With 1 text fig.**

The organism that is the subject of this note was isolated from an elephant which had been dead 36 hours before the post-mortem examination was made.

The following lesions were found at the post-mortem: There was a yellow gelatinous exudate in the tissues about the throat. The blood was thick and dark in colour. The pleural and pericardial cavities contained a blood-stained serous exudate. There was marked inflammation of the lungs, and the heart shewed a number of petechiae. The spleen was enlarged, and there were areas of extravasation under the capsule. The pulp was soft. The mesenteric glands were soft and congested. The stomach and intestines were

severely inflamed, the wall of the latter being thickened with exudate.

Microscopic examination of the various organs and fluids shewed a number of diplo-coccoid bacteria and a large number of accidental organisms. Primary cultures were not pure, but pure cultures of the coccoid organism were obtained on subcultivation. The organism was about 0·5 microns in length and stained uniformly. Its cultural characters were those of the fowl cholera bacillus.

A pigeon inoculated with the culture was dead in 8 hours, and pure cultures were obtained from the blood. Two rabbits inoculated endermically with blood from the elephant died in 18 to 24 hours. The lesions presented were those of haemorrhagic septicaemia and the blood contained large numbers of the bacteria. Pure cultures were obtained.

Book Received.

(196) M'Gowan (J. P.). [M.A., M.D., B.Sc., M.R.C.P.E.] **Investigation into the Disease of Sheep called "Scrapie" (Traberkrankheit; La Tremblante) with Especial Reference to its Association with Sarcosporidiosis. With an Appendix on a Case of Johne's Disease in the Sheep.**—xi + 116 pp. Demy 8vo. With 26 figs. 1914. Edinburgh: William Blackwood & Sons. (Edinburgh and East of Scotland College of Agriculture.) [Price not stated.]

[The following list of chapter headings indicates the scope of the book:—History of the disease in Britain. The disease as it occurs in other countries of Europe, and especially in Germany and France. Symptoms and pathology of the disease. Account of a case of Scrapie seen in Germany. The structure and possible developmental stages of the Sarcocyst and their relation to the spread of the disease. Symptoms exhibited by animals heavily infected with Sarcosporidia. On the action of the Sarcocystin, the toxin produced by the Sarcocyst. On the mode of spread of Sarcosporidiosis from animal to animal in carnivorous animals. Method of spread of Sarcosporidiosis in graminivorous animals. Observations as to the presence of Sarcocysts in the muscles of apparently healthy sheep. Epizootiology. Conclusions and recommendations. Appendix on a case of Johne's disease in the sheep. Glossary.]

RECENT LITERATURE.

[Continued from *Bulletin*, Vol. 2, No. 1, pp. 58-60.]

Babesiasis (Piroplasmosis).

(197) NAUDIN (L.). Contribution à l'Etude de la Piroplasmose canine. [Contribution to the Study of Canine Piroplasmosis.]—*Rev. Gén. Méd. Vétër.* 1914. Jan. 1. Vol. 23. No. 265. pp. 18 to 19.

(198) ZIEMANN (H.). Weiteres über die Zuchtung der Malariaparasiten und der Piroplasmen (*Piroplasma canis*) *in vitro*. [Further studies on the Cultivation of the Malaria Parasites and Piroplasms (*Piroplasma canis*) *in vitro*.]—*Arch. f. Schiffs- u. Trop.-Hyg.*, 1914. Feb. Vol. 18. No. 3, pp. 77–93. With one curve.

Filariasis.

(199) SULDEY (E. W.). Existence d'une Filaire et d'une Microfilaire chez le Caméléon de Madagascar. [The Occurrence of a Filaria and a Microfilaria in the Chameleon in Madagascar.]—*Bull. Soc. Path. Exot.*, 1914. Jan. Vol. 7. No. 1, pp. 70–71.

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(200) LIGNOS (A.). La Mortalité par Kala azar à Hydra pendant l'Année, 1911. [The Mortality caused by Kala azar in the Island of Hydra during 1911.]—*Bull. Soc. Path. Exot.*, 1914. Mar. Vol. 7. No. 3, p. 193.

(201) PITTALUGA (G.). Kala azar infantile e Leishmaniosi canina in Ispagna. [Infantile Kala azar and Canine Leishmaniasis in Spain.]—*Pathologica*, 1914. Mar. 1. Vol. 6. No. 128, pp. 121–122.

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(203) KOZEWALOW (S.). Zur Virulenz des fixen Virus der Tollwut für den Menschen. [The Virulence of the Fixed Virus of Rabies for Man.]—*Centralbl f. Bakt.* 1. Abt. Orig., 1914. Feb. 11. Vol. 73. No. 1, pp. 54–71.

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